## Procurement Schedule

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<td>December 4, 2019</td>
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<td>December 11, 2019 at 3:45 PM</td>
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<td></td>
<td>Boonsboro High School</td>
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<tr>
<td></td>
<td>10 Campus Avenue</td>
</tr>
<tr>
<td></td>
<td>Boonsboro, MD 21713</td>
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<tr>
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<td>December 24, 2019 at 12:00 PM EST</td>
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<tr>
<td>Bid Due</td>
<td>January 14, 2019 at 11:00 AM EST</td>
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<td>Washington County Public Schools</td>
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<td>Center for Education Services</td>
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<tr>
<td></td>
<td>10435 Downsville Pike</td>
</tr>
<tr>
<td></td>
<td>Hagerstown, Maryland 21740</td>
</tr>
<tr>
<td>Tentative Award Date</td>
<td>February 2020</td>
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*Dates and/or times are subject to change by the issuing of a written addendum.*

## WCPS Contract Managers

**Procurement Officer**
Scott Bachtell  
Supervisor of Purchasing  
301-766-2842  
[bachtsco@wcps.k12.md.us](mailto:bachtsco@wcps.k12.md.us)

**Contract Administrator**
Brad Otto, P.E.  
Project Manager  
301-730-2189  
[ottobra@wcps.k12.md.us](mailto:ottobra@wcps.k12.md.us)

This bid document is posted on the WCPS Purchasing website at [www.wcspurchasing.com](http://www.wcspurchasing.com). This is also the source for any/all addenda. Please register your company for notices about this bid and similar projects on our web site.
WASHINGTON COUNTY PUBLIC SCHOOLS
BOONSBORO HIGH SCHOOL
- AUDITORIUM & STAGE RENOVATIONS
BFM PROJECT NO. 16060

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DIRECTORY

BOONSBORO HIGH SCHOOL
AUDITORIUM & STAGE RENOVATIONS
WASHINGTON COUNTY PUBLIC SCHOOLS
WCPS BID NO. 2020-18
BFM NO. 16020

OWNER:
WASHINGTON COUNTY PUBLIC SCHOOLS
10435 Downsville Pike
Hagerstown, MD 21740
Brad Otto, P.E., Project Manager e-mail: ottobra@wcps.k12.md.us
Telephone: 301-766-2817

ARCHITECT:
BUSHEY FEIGHT MORIN ARCHITECTS INC.
473 North Potomac Street
Hagerstown, MD 21740
Brent A. Feight: Principal-in-Charge e-mail: bfeight@BFMArchitects.com
Andrew S. Reichard, Project Architect e-mail: areichard@BFMArchitects.com
Telephone: 301-733-5600

CIVIL ENGINEER:
TRIAD ENGINEERING, INC.
1075 Sherman Ave # D
Hagerstown, MD 21740
Billie Swailes, P.E., Project Manager e-mail: bswailes@triadeng.com
Telephone: 301-797-6400

STRUCTURAL ENGINEER:
MATONAK & ASSOCIATES
P.O. Box 887
Hagerstown, MD 21741
Daniel Matonak, P.E. e-mail: dan@strengthengineering.com
Telephone: 301-790-0111

MECH/PLMB/ELECTRICAL ENGINEER:
CJL ENGINEERING
5285 Westview Drive
Frederick, MD 21703
Chris Mills, P.E. e-mail: cmills@cjlengineering.com
Telephone: 301-695-9424
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INVITATION TO BID

December 4, 2019

Bid: 2020-18 Auditorium and Stage Renovations at Boonsboro High School

Pre-Bid Meeting: Boonsboro High School
10 Campus Avenue
Boonsboro, MD 21713

Bid Inquiries to: Brad Otto, P.E. ottobra@wcps.k12.md.us
Scott Bachtell bachtsco@wcps.k12.md.us

Place of Bid Opening: WCPS Center for Education Services (CES)
10435 Downsville Pike, Hagerstown, MD 21740

Bids shall be submitted in duplicate, along with additional documentation required per the Bid Solicitation instructions, in a Sealed Envelope showing bid name and due date on the outside of the envelope. Faxed or e-mailed bids will not be accepted. Bids delivered in person should be handed to a Purchasing Department staff member prior to the bid due date/time to ensure the bid is properly filed in advance of the Bid Opening.

Bids not received prior to the day/time designated for the bid opening, or bids not submitted to the Purchasing Staff may not be properly filed. Such bids, upon discovery by the Purchasing Official, will be refused and/or returned unopened to the Bidder. The Purchasing Department is open Monday through Friday, 8:00 am – 12:00 pm and 1:00 pm – 4:30 pm local time, except national and school holidays.

Address Mail or Delivery Package to:

Attention: Scott Bachtell, Supervisor of Purchasing
Telephone: (301) 766-2842

Building a Community That Inspires Curiosity, Creativity, and Achievement.
TO VIEW CURRENT SOLICITATIONS, PLEASE SEE THIS WEB ADDRESS:
http://wcpspurchasing.com/bids/opportunities

FOR BID RESULTS, PLEASE SEE THIS WEB ADDRESS:
http://wcpspurchasing.com/bids/results

Bid Solicitation Document includes the following:
√ Instructions to Bidders (AIA A701)
√ General Conditions (AIA A201)
√ Technical Specifications
√ Signature Sheet
√ Terms & Conditions (AIA A101)
√ Plans/Drawings/Schematics
√ Proposal Form

NOTICE
Notice is hereby given that Washington County Public Schools will accept sealed bids for the purpose of establishing a contract to construct auditorium and stage renovations as outlined in the contract documents. The Contract /Bid Solicitation Documents were prepared by Bushey Feight Morin Architects (the Architect) and Washington County Public Schools (the Owner). Below is a summary of the project:

The successful Bidders shall furnish all labor, materials, equipment, and services necessary for, and incidental to, performing the work specified in the enclosed Technical Specifications and Drawings for the construction project 2020-18, Auditorium and Stage Renovations at Boonsboro High School. The construction contract will be awarded to the lowest responsible bidder with consideration given to quantities involved; time required for delivery; the purpose for which required; the competency and responsibility of the bidder; and the ability of the bidder to perform satisfactory service. The Washington County Board of Education (“WCBOE”) may reject any and all bids and re-advertise for other bids.

BIDS DUE
Sealed bids will be received at the Washington County Public Schools Center for Education Services Purchasing Office at 10435 Downsville Pike, Hagerstown, Maryland, 21740.

Bids will be opened and read aloud at that time. Bids received after that time will not be accepted and will be returned unopened. Interested parties are invited to attend.

No bidder may withdraw his bid for a minimum period of sixty (60) calendar days after the day of the bid opening.
BID SOLICITATION AVAILABILITY

Contractors may obtain the files that comprise the Bid Solicitation Document from the Purchasing Website on the following basis:

1. The solicitation document is available for viewing and download from the WCPS Purchasing Web site: www.wcpspurchasing.com. The bid solicitation document is made available to any person or company who chooses to obtain it from the website. **To submit a bid, prequalification is a requirement.** All contractors who have obtained a copy of the document from the website or by other means may not be eligible to submit a bid. **Only the WCPS Purchasing Office can grant approval to bid. Only pre-qualified contractors are eligible to bid this project.** Registration via the WCPS website is mandatory and is a two-step process. Approval at step one of the application is not sufficient for bidding construction work. WCPS Purchasing Office will notify each contractor in writing upon approval of the application to bid construction projects.

2. To check whether or not your company is pre-qualified, you may contact the Purchasing Office by calling Beverly Bergan at 301-766-2841, or by email to: bergabev@wcps.k12.md.us. The Bid Solicitation consists of electronic files which provide instructions, technical specifications, drawings, and supplemental addenda issued prior to the bid opening.

3. The Bidder assumes all responsibility for downloading all electronic files and for coordinating any pertinent information contained in the Bidding Documents. Downloading/viewing only specific files or partial information will not relieve the contractor or subcontractor from the work indicated on other drawings or specifications comprising the complete bid solicitation.

4. Bids received from contractors who have not been pre-qualified seven days prior to the bid opening date may be refused or returned unopened to them. To become pre-qualified, complete the Prequalification Registration online by visiting our website, http://wcpspurchasing.com/vendors-contractors/becoming-wcps-vendor.

5. Contractors and subcontract bidders must be licensed to perform construction work in the State of Maryland in order to be eligible to bid. Contractors must meet WCPS’ eligibility requirements in order to bid this project as a prime bidder.
OBJECTION TO AWARD
Any company objecting to the bid procedure or the recommendation for award has five (5) business days following the date of award by the Board of Education to file a written protest with the Superintendent of Schools. It is the company’s responsibility to ascertain and confirm the date/time of the pertinent Board Meeting. The written appeal must be submitted on company letterhead, dated and signed by the senior officer in the company. The protest letter must include a request for review and ruling by WCPS, a detailed statement of the legal and factual grounds for the protest, including the resulting prejudice to the company, copies of relevant documents, and a statement of the form of relief being requested. Failure to comply with these instructions may result in the protest being deemed “not filed.” Bid protests received later than five (5) days after the Board Meeting will result in the protest being deemed “not timely.” WCPS will not respond or address bid protests that do not conform to these instructions.

BIDDING REQUIREMENTS
Bid Security Bond in the amount of 5% of the Total Bid is required from all Bidders. The Bid Security Bond serves as security for obtaining Performance Bond and Payment Bonds in 100% of the Contract amount from the successful bidder within ten (10) days from Notice of Award of the Contract. Bidder must use the AIA bond form versions provided herein. Only AIA forms that have been reviewed for acceptance by WCPS legal counsel will be acceptable. The Owner may make such investigations as he deems necessary to determine the ability of the Bidder to perform the Work, and prospective Bidders may be required to furnish evidence of performance of similar projects of similar magnitude and complexity and all such information and data as requested. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the Owner that such bidder is properly qualified to carry out the obligation of the Contract and to complete the Work contemplated therein. The Owner reserves the right to reject any or all bids, to waive irregularities in the bids, select alternates in any order and to make the award in the manner that the WCBOE determines will best serve the interests of WCPS.

By order of: Washington County Public Schools
Scott Bachtell, Supervisor of Purchasing
WASHINGTON COUNTY PUBLIC SCHOOLS
Hagerstown, Maryland

Auditorium and Stage Renovations
at Boonsboro High School

FORM OF PROPOSAL – BID 2020-18

Proposal of ____________________________________________
(Corporation, a partnership, or an individual hereinafter called “Bidder”) organized and doing business and existing under the laws of the state of ________________________________.

I/We as the Bidder, in compliance with the Invitation to Bid for the selected contract package included herein, have examined the Bidding Documents, and have become familiar with all the conditions surrounding the construction of the proposed project, including the availability of materials and labor, hereby propose to furnish all labor, materials, services and equipment necessary to properly complete the Work in accordance with the Contract Documents and Addenda, and at the prices stated below. These prices are to cover all expenses incurred in performing the Work required under the Contract Documents, of which this Proposal is a part.

All prices include all applicable sales and/or use taxes; include all insurance premiums required and include all premiums for a Performance Bond and a Labor and Material Payment Bond in the sum of one hundred percent (100%) of the Contract price. A five percent (5%) Bid Bond shall be attached to the Proposal. The Bid Bond amount shall be computed on the Lump Sum Total Price inclusive of Alternate Values; shall be submitted with the Washington County Board of Education as the sole obligee, and shall be issued for a minimum period of sixty (60) calendar days from the receipt of Bids.

PREQUALIFICATION
To become prequalified to bid this project, visit our website: http://wcpspurchasing.com/vendors-contractors/becoming-wcps-vendor. The application to participate as a prime bidder in a construction or related project is a two-step process and both steps of the process must be successfully completed in order to submit a bid. Bids received from contractors who have not been pre-qualified by the Purchasing Officer at least seven days prior to the bid opening will be refused or returned unopened to the sender.

COMPLETION TIME – SCHEDULE OF WORK
I/We as the Bidder, agree to begin to perform the Work at the time stated in the “Notice of Award/Notice to Proceed” and to substantially complete the entire work in accordance with the provisions of the Contract Documents. If this work is not completed within the time period specified, I/we will be liable for Liquidated Damages of $500.00 per calendar day.
BASE BID
Bidders furnish all labor, materials, services, and equipment necessary to properly complete the Work required for the project in strict accordance with the Contract Documents for the following lump sum total:

Lump Sum Total:

___________________________________DOLLARS (Amount in words)

$                                          _____________________________________________DOLLARS (Amount in numbers)

ADD ALTERNATES
The prices stated below are for the complete installation of the Alternate Work as described herein. The prices for Alternate Bids do not form a portion of the Contractor’s Base Bid, but if accepted, will be added to the Base Bid to determine the total Contract Sum. The Owner reserves the right to accept or reject any or all Alternates in any order or combination. Acceptance or rejection of any Alternates does not relieve the Contractor of timely completion of the Work within the time periods indicated. The Contract Documents shall be considered appropriately modified by either the acceptance or rejection of Alternates.

Alternate Bids shall include all costs associated with the described Alternate or reasonably inferable therefrom. Claims for increases to the Contract Sum resulting from changes caused by the acceptance or rejection of any Alternate Bid will not be allowed.

See Specification Section “01 15 00 – Alternates” for further information regarding scopes of work.

Add Alternate 1: Security Vestibule

Lump Sum Total:

___________________________________DOLLARS (Amount in words)

$                                          _____________________________________________DOLLARS (Amount in numbers)
**Add Alternate 2:** Terrazzo tile in 105 – Gathering/Display

**Lump Sum Total:**

______________________________ DOLLARS
(Amount in words)

$______________________________ DOLLARS
(Amount in numbers)

**Add Alternate 3:** Restroom 116, Restroom 117, Custodial Closet, Interior Ramp

**Lump Sum Total:**

______________________________ DOLLARS
(Amount in words)

$______________________________ DOLLARS
(Amount in numbers)

**Add Alternate 4:** 119 Covered Walkway

**Lump Sum Total:**

______________________________ DOLLARS
(Amount in words)

$______________________________ DOLLARS
(Amount in numbers)
Add Alternate 5: 114 Storage Addition

Lump Sum Total:

___________________________________DOLLARS
(Amount in words)

$___________________________________DOLLARS
(Amount in numbers)

Add Alternate 6: Linear Ceiling & Lighting in 103, 105, 106

Lump Sum Total:

___________________________________DOLLARS
(Amount in words)

$___________________________________DOLLARS
(Amount in numbers)

ADDENDA
The following Addenda have been received and reviewed and all Work therein is incorporated in the Bid Form of Proposal:

(If none please write “NONE”):

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ATTACHMENTS
The following items are mandatory and are to be included with the Bid Form of Proposal and shall be completed by the Bidder:

1. WCPS Bid/Proposal Affidavit
2. Bid Security – See Section 00 43 13 – AIA Document A310 -2010 Bid Bond
REPRESENTATIONS

I/We as the Bidder, have reviewed the complete AIA Document A701 – 1997 “Instructions to Bidders,” as modified by the Washington County Board of Education, and agree with the terms and conditions specified therein and submit this Bid Proposal in accordance.

The Owner reserves the right to reject any or all Bids. The Owner shall have the right to waive informalities and irregularities in the bids and in the bidding process and to accept the Bid which, in the Owner’s judgment, is in the Owner’s own best interests. A Bid not accompanied by a required bid security, or by other data required by the Bidding Documents, or a Bid which is in any way incomplete or irregular, is subject to rejection.

No Bidder shall withdraw, modify, or cancel his bid, or any part thereof, for a minimum of sixty (60) calendar days after the receipt of bids. The undersigned shall complete the total Work within the timeframe previously stated once the Owner indicates acceptance of this Bid Proposal by way of a written “Notice of Award” or “Letter of Intent” within this minimum sixty (60) day time period, or any time thereafter before the Bid is withdrawn.

I/We certify that this Bid is made without previous understanding, agreement, or connection with any person, firm or corporation submitting a bid for the same items and/or services and is, in all respects fair and without collusion or fraud; that none of this company’s officers, directors or its employees have been convicted of bribery, attempted bribery, or conspiracy to bribe under the laws of any state or federal government; and that no member of the Board of Education of Washington County, administrative or supervisory personnel or other employees of Washington County Public Schools have any interest in the bidding company except as follows: (complete if applicable)

________________________________________________________________________________
________________________________________________________________________________

Respectfully submitted,

By ________________________________

(Company)

______________________________

(Signature) ________________________________

(Date) ________________________________

(Printed Name) ________________________________

(Title) ________________________________

(Business Address) ________________________________

(Phone) ________________________________

(e-mail address) ________________________________
(SEAL) If bid is by Corporation 
I/we the bidder represent, and agree that it is a precedent to acceptance of this bid, that the bidder has not been a party to any agreement to bid of fixed or uniform price.

__________________________________________________________
(Signature of Office & Title)                                          (SEAL)

SUBSCRIBED AND SWORN to before me, a Notary Public in the State of ________________ , 
County of _________________________ City of _______________________ this 
________________________ day of __________________, 20___.

Commission Expires: _____________________________________________

**NOTICE:** The Washington County Board of Education reserves the right to award any, all, or none due to budgetary constraints.

**END OF FORM OF PROPOSAL 00 20 00**
MANDATORY BID/PROPOSAL AFFIDAVIT

COMAR 21.05.08.07

Bidder shall complete and submit this bid/proposal affidavit to the Supervisor of Purchasing, Washington County Public Schools with the bid or offer.

A. AUTHORITY

I HEREBY AFFIRM THAT:

I (print name)________________________________________ possess the legal authority to make this Affidavit.

B. CERTIFICATION REGARDING COMMERCIAL NONDISCRIMINATION

The undersigned bidder hereby certifies and agrees that the following information is correct: In preparing its bid on this project, the bidder has considered all proposals submitted from qualified, potential subcontractors and suppliers, and has not engaged in “discrimination” as defined in §19-103 of the State Finance and Procurement Article of the Annotated Code of Maryland. “Discrimination” means any disadvantage, difference, distinction, or preference in the solicitation, selection, hiring, or commercial treatment of a vendor, subcontractor, or commercial customer on the basis of race, color, religion, ancestry, or national origin, sex, age, marital status, sexual orientation, or on the basis of disability or any otherwise unlawful use of characteristics regarding the vendor’s, supplier’s or commercial customer’s employees or owners. “Discrimination” also includes retaliating against any person or other entity for reporting any incident of “discrimination”. Without limiting any other provision of the solicitation on this project, it is understood that, if the certification is false, such false certification constitutes grounds for the State to reject the bid submitted by the bidder on this project, and terminate any contract awarded based on the bid. As part of its bid or proposal, the bidder herewith submits a list of all instances within the past 4 years where there has been a final adjudicated determination in a legal or administrative proceeding in the State of Maryland that the bidder discriminated against subcontractors, vendors, suppliers, or commercial customers, and a description of the status or resolution of that determination, including any remedial action taken. Bidder agrees to comply in all respects with the State’s Commercial Nondiscrimination Policy as described under Title19 of the State Finance and Procurement Article of the Annotated Code of Maryland.

B-1 Certification Regarding Minority Business Enterprises.

The undersigned bidder hereby certifies and agrees that it has fully complied with the State Minority Business Enterprise Law, State Finance and Procurement Article, §14-308 (a)(2), Annotated Code of Maryland, which provides that, except as otherwise provided by law, a contractor may not identify a certified minority business enterprise in a bid or proposal and:
(1) Fail to request, receive, or otherwise obtain authorization from the certified minority business enterprise to identify the certified minority proposal;

(2) Fail to notify the certified minority business enterprise before execution of the contract of its inclusion in the bid or proposal;

(3) Fail to use the certified minority business enterprise in the performance of the contract; or

(4) Pay the certified minority business enterprise solely for the use of its name in the bid or proposal.

Without limiting any other provision of the solicitation on this project, it is understood that if the certification is false, such false certification constitutes grounds for the State to reject the bid submitted by the bidder on this project, and terminate any contract awarded based on the bid.

C. AFFIRMATION REGARDING BRIBERY CONVICTIONS

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business (as is defined in Section 16-101(b) of the State Finance and Procurement Article of the Annotated Code of Maryland), or any of its officers, directors, partners, controlling stockholders, or any of its employees directly involved in the business's contracting activities including obtaining or performing contracts with public bodies has been convicted of, or has had probation before judgment imposed pursuant to Criminal Procedure Article, §6-220, Annotated Code of Maryland, or has pleaded nolo contendere to a charge of bribery, attempted bribery, or conspiracy to bribe in violation of Maryland law, or of the law of any other state or federal law, except as follows (indicate the reasons why the affirmation cannot be given and list any conviction, plea, or imposition of probation before judgment with the date, court, official or administrative body, the sentence or disposition, the name(s) of person(s) involved, and their current positions and responsibilities with the business):

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

D. AFFIRMATION REGARDING OTHER CONVICTIONS

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business, or any of its officers, directors, partners, controlling stockholders, or any of its employees directly involved in the business's contracting activities including obtaining or performing contracts with public bodies, has:
(1) Been convicted under state or federal statute of:

   (a) A criminal offense incident to obtaining, attempting to obtain, or performing a public or private contract; or

   (b) Fraud, embezzlement, theft, forgery, falsification or destruction of records or receiving stolen property;

(2) Been convicted of any criminal violation of a state or federal antitrust statute;

(3) Been convicted under the provisions of Title 18 of the United States Code for violation of the Racketeer Influenced and Corrupt Organization Act, 18 U.S.C. §1961 et seq., or the Mail Fraud Act, 18 U.S.C. §1341 et seq., for acts in connection with the submission of bids or proposals for a public or private contract;

(4) Been convicted of a violation of the State Minority Business Enterprise Law, §14-308 of the State Finance and Procurement Article of the Annotated Code of Maryland;

(5) Been convicted of a violation of §11-205.1 of the State Finance and Procurement Article of the Annotated Code of Maryland;

(6) Been convicted of conspiracy to commit any act or omission that would constitute grounds for conviction or liability under any law or statute described in subsections (1)—(5) above;

(7) Been found civilly liable under a state or federal antitrust statute for acts or omissions in connection with the submission of bids or proposals for a public or private contract; or

(8) Been found in a final adjudicated decision to have violated the Commercial Nondiscrimination Policy under Title 19 of the State Finance and Procurement Article of the Annotated Code of Maryland with regard to a public or private contract; or

(9) Admitted in writing or under oath, during the course of an official investigation or other proceedings, acts or omissions that would constitute grounds for conviction or liability under any law or statute described in §§B and C and subsections D (1)- (8) above, except as follows (indicate reasons why the affirmations cannot be given, and list any conviction, plea, or imposition of probation before judgment with the date, court, official or administrative body, the sentence or disposition, the name(s) of the person(s) involved and their current positions and responsibilities with the business, and the status of any debarment):

E. AFFIRMATION REGARDING DEBARMENT
I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business, or any of its officers, directors, partners, controlling stockholders, or any of its employees directly involved in the business's contracting activities, including obtaining or performing contracts with public bodies, has ever been suspended or debarred (including being issued a limited denial of participation) by any public entity, except as follows (list each debarment or suspension providing the dates of the suspension or debarment, the name of the public entity and the status of the proceedings, the name(s) of the person(s) involved and their current positions and responsibilities with the business, the grounds of the debarment or suspension, and the details of each person's involvement in any activity that formed the grounds of the debarment or suspension).

F. AFFIRMATION REGARDING DEBARMENT OF RELATED ENTITIES

I FURTHER AFFIRM THAT:

(1) The business was not established and it does not operate in a manner designed to evade the application of or defeat the purpose of debarment pursuant to Sections 16-101, et seq., of the State Finance and Procurement Article of the Annotated Code of Maryland; and

(2) The business is not a successor, assignee, subsidiary, or affiliate of a suspended or debarred business, except as follows (you must indicate the reasons why the affirmations cannot be given without qualification):

G. SUB-CONTRACT AFFIRMATION

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business, has knowingly entered into a contract with a public body under which a person debarred or suspended under Title 16 of the State Finance and Procurement Article of the Annotated Code of Maryland will provide, directly or indirectly, supplies, services, architectural services, construction related services, leases of real property, or construction.
H. AFFIRMATION REGARDING COLLUSION

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business has:

(1) Agreed, conspired, connived, or colluded to produce a deceptive show of competition in the compilation of the accompanying bid or offer that is being submitted;

(2) In any manner, directly or indirectly, entered into any agreement of any kind to fix the bid price or price proposal of the bidder or offeror or of any competitor, or otherwise taken any action in restraint of free competitive bidding in connection with the contract for which the accompanying bid or offer is submitted.

I. CERTIFICATION OF TAX PAYMENT

I FURTHER AFFIRM THAT:

Except as validly contested, the business has paid, or has arranged payment of, all taxes due the State of Maryland and has filed all required returns and reports with the Comptroller of the Treasury, the State Department of Assessments and Taxation, and the Department of Labor, Licensing, and Regulation, as applicable, and will have paid all withholding taxes due the State of Maryland prior to final settlement.

J. CONTINGENT FEES

I FURTHER AFFIRM THAT:

The business has not employed or retained any person, partnership, corporation, or other entity, other than a bona fide employee, bona fide agent, bona fide salesperson, or commercial selling agency working for the business, to solicit or secure the Contract, and that the business has not paid or agreed to pay any person, partnership, corporation, or other entity, other than a bona fide employee, bona fide agent, bona fide salesperson, or commercial selling agency, any fee or any other consideration contingent on the making of the Contract.

K. ACKNOWLEDGEMENT

I ACKNOWLEDGE THAT this Affidavit is to be furnished to the Procurement Officer and may be distributed to units of: (1) the State of Maryland; (2) counties or other subdivisions of the State of Maryland; (3) other states; and (4) the federal government. I further acknowledge that this Affidavit is subject to applicable laws of the United States and the State of Maryland, both criminal and civil, and that nothing in this Affidavit or any contract resulting from the submission of this bid or proposal shall be construed to supersedes, amend, modify or waive, on behalf of the State of Maryland, any unit of the State of Maryland having jurisdiction, the exercise of any statutory right or remedy conferred by the constitution and the laws of Maryland with respect to any misrepresentation made or any violation of the
obligations, terms, and covenants undertaken by the above business with respect to (1) this Affidavit, (2) the contract, and (3) other Affidavits comprising part of the contract.

I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.

Date:______________________________________

By:

__________________________________________
(Print name of Authorized Representative and Affiant)

__________________________________________
(Signature of Authorized Representative and Affiant)

__________________________________________
(Company name)
Instructions to Bidders

for the following PROJECT:
(Name and location or address):
2019-19 Clear Spring Middle School Security Vestibule
Clear Spring Middle School
12627 Broadfording Rd
Clear Spring, MD 21722

THE OWNER:
(Name and address):
Washington County Board of Education 10435 Downsville Pike
Hagerstown, MD 21740

THE ARCHITECT:
(Name and address):

TABLE OF ARTICLES

1 DEFINITIONS
2 BIDDER’S REPRESENTATIONS
3 BIDDING DOCUMENTS
4 BIDDING PROCEDURES
5 CONSIDERATION OF BIDS
6 POST-BID INFORMATION
7 PERFORMANCE BOND AND PAYMENT BOND
8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An Additions and Deletions Report that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.
ARTICLE 1  DEFINITIONS
§ 1.1 Bidding Documents include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Advertisement or Invitation to Bid, Instructions to Bidders, Supplementary Instructions to Bidders, the bid form, and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications and all Addenda issued prior to execution of the Contract.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201 as modified by the Board of Education of Washington County, or in other Contract Documents are applicable to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect prior to the execution of the Contract which modify or interpret the Bidding Documents, including Drawings and Specifications, by additions, deletions, clarifications or corrections. Addenda will become part of the Contract Documents when the Construction Contract is executed.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which Work may be added or from which Work may be deleted for sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment or services or a portion of the Work as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment or labor for a portion of the Work.

ARTICLE 2  BIDDER'S REPRESENTATIONS
§ 2.1 The Bidder by making a Bid represents that:
§ 2.1.1 The Bidder has read and understands the Bidding Documents or Contract Documents, to the extent that such documentation relates to the Work for which the Bid is submitted, and for other portions of the Project, if any, being bid concurrently or presently under construction.

§ 2.1.2 The Bid is made in compliance with the Bidding Documents.

§ 2.1.3 The Bidder has visited the site, become familiar with local conditions under which the Work is to be performed and has correlated the Bidder’s personal observations with the requirements of the proposed Contract Documents.

§ 2.1.4 The Bid is based upon the materials, equipment and systems required by the Bidding Documents without exception.

§ 2.1.5 Generally, neither law nor regulations make allowance for negligent errors either of omission or commission on the part of the bidders. Each Bidder, by making his Bid, represents that he has read and understands the Bidding Documents. Failure of the Bidder to thoroughly understand all aspects of the Solicitation before submitting his Bid will not act as an excuse to permit withdrawal of his Bid nor secure relief on plea of error.

§ 2.1.6 Once the Contract is awarded to the successful Bidder, no claims for any extra work will be allowed because of alleged impossibilities in the production of the results specified, or because of inadequate or improper plans or
specifications, and whenever a result is required, the successful Bidder shall furnish any and all extras and make any changes needed to produce, to the satisfaction of the Owner, the required results.

§ 2.1.7 The Bidder shall warrant that no person or selling agency has been employed or retained to solicit or secure the Contract upon an agreement of understanding for a commission or percentage, brokerage or contingent fee excepting bona fide employees or bona fide established commercial or selling agencies maintained by the bidder for the purpose of securing business. For breach or violation of the warrantee the Owner shall have the right to annul the Contract without liability or at its discretion to deduct from the contract price or otherwise recover the full amount of such commission, percentage, brokerage, or contingent.

§ 2.1.8 The Bidder, by the submission of this Bid agrees as a supplier of good, materials, equipment, or services covered by this Bid or the Contract that he will not discriminate in the employment in any way against any person or persons because of their race, creed, color, sex, national origin, age, or handicap. The Owner does not discriminate on the basis of race, color, sex, age, national origin, religion, or disability.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 COPIES

§ 3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Advertisement or Invitation to Bid. Either a CD on which all of the Bidding Documents have been scanned or one (1) hard copy set of Bidding Documents will be issued to each bonafide bidder.

§ 3.1.2 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the Advertisement or Invitation to Bid, or in supplementary instructions to bidders.

§ 3.1.3 Bidders shall use complete sets of Bidding Documents in preparing Bids; neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

§ 3.1.4 The Owner and Architect may make copies of the Bidding Documents available on the above terms for the purpose of obtaining Bids on the Work. No license or grant of use is conferred by issuance of copies of the Bidding Documents.

§ 3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

§ 3.2.1 The Bidder shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which the Bid is submitted, shall examine the site and local conditions, and shall at once report to the Architect errors, inconsistencies or ambiguities discovered.

§ 3.2.2 Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Architect at least seven days prior to the date for receipt of Bids.

§ 3.2.3 Interpretations, corrections and changes of the Bidding Documents will be made by Addendum. Interpretations, corrections and changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon them.

§ 3.2.4 Questions shall be in writing and sent to the Owner for interpretation and/or clarification.

§ 3.3 SUBSTITUTIONS

§ 3.3.1 The materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution.

§ 3.3.2 No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Bids. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other
§ 3.3 Contracts that incorporation of the proposed substitution would require, shall be included. The burden of proof of the
merit of the proposed substitution is upon the proposer. Where less than three (3) manufacturers or products are listed
in the Specifications, or the specification lists “Approved Equal” as an acceptable product, the burden of proof of
equivalency rests with the Contractor and evidence shall be submitted to the Architect and approved by Architect with
final approval to be determined by the Owner. Criteria includes but is not limited to performance, materials,
craftsmanship, quality control, certification procedures or requirements, warranty, installation procedures, etc.
Any proposed substitution, or proposed equal product, must be submitted to the Architect for review, 10 days prior to the
bid date. After the receipt of bids and award of the Contract, the Owner and Architect are under no obligation to
review or approve requests for substitution or equal products that were not specifically mentioned in the
Specifications. The Owner reserves the right to request a substitute at any time in the project.

§ 3.3.3 If the Architect approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an
Addendum. Bidders shall not rely upon approvals made in any other manner.

§ 3.3.4 No substitutions will be considered after the Contract award unless specifically provided for in the Contract
Documents.

§ 3.4 ADDENDA

§ 3.4.1 Addenda will be transmitted to all who are known by the issuing office to have received a complete set of
Bidding Documents.

§ 3.4.2 Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that
purpose.

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids except an Addendum
withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Each Bidder shall ascertain prior to submitting a Bid that the Bidder has received all Addenda issued, and the
Bidder shall acknowledge their receipt in the Bid.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 PREPARATION OF BIDS

§ 4.1.1 Bids shall be submitted on the forms included with the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and figures. In case of discrepancy, the amount written in words shall
govern.

(Paragraph deleted)

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter “No Change.”

(Paragraph deleted)

§ 4.1.7 Each copy of the Bid shall state the legal name of the Bidder and the nature of legal form of the Bidder. The
Bidder shall provide evidence of legal authority to perform within the jurisdiction of the Work. Each copy shall be
signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further
give the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current
power of attorney attached certifying the agent’s authority to bind the Bidder.

§ 4.1.8 The contractor or subcontractor shall use or supply American steel products in performance of this Contract in
accordance with the Annotated Code of Maryland, State Finance and Procurement
Article 17-301 – 17-306 as implemented in the Code of Maryland Regulations (COMAR) 21.11.02.

§ 4.2 BID SECURITY

§ 4.2.1 Each Bid shall be accompanied by a bid security in the form and amount required. The Bidder pledges to enter
into a Contract with the Owner on the terms stated in the Bid and will furnish bonds covering the faithful performance
of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract

portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law. This document was
produced by AIA software at 16:13:11 on 02/05/2015 under Order No.3528535459_1 which expires on 05/17/2015, and is not for resale.

User Notes:
or fail to furnish such bonds, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. The successful Bidder, upon his failure or refusal to execute and deliver the bonds required in Article 7 within ten (10) days after Notice of Award of the Contract shall forfeit to the Owner, as liquidated damages for such failure or refusal, the security deposited with his Bid.

§ 4.2.1.1 Bid bond shall be in the amount of five percent (5%) of the total Bid and shall be submitted with the Washington County Board of Education as the sole obligee and shall be issued for a period of sixty (60) calendar days from the receipt of Bids.

§ 4.2.2 Surety bond shall be written on AIA Document A310, Bid Bond and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney.

§ 4.2.3 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either (a) the Contract has been executed and bonds, if required, have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn or (c) all Bids have been rejected.

§ 4.3 SUBMISSION OF BIDS

§ 4.3.1 All copies of the Bid, the bid security and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder’s name and address and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof. Submit the Standard Form of Proposal and required documents in duplicate.

§ 4.3.2 Bids shall be deposited at the designated location prior to the time and date for receipt of Bids. Bids received after the time and date for receipt of Bids will be returned unopened.

§ 4.3.3 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.4 Oral, telephonic, telegraphic, facsimile or other electronically transmitted bids will not be considered.

§ 4.3.5 All prospective bidders must be currently pre-qualified with the WCPS Purchasing Department to be eligible to participate in the bidding process.

§ 4.3.6 Upon request of the Owner, Bidders should be prepared to provide a list of major subcontractors after submission of bids and within two (2) business days of the request.

§ 4.3.7 Errors in bids: Bidders or their authorized representatives are expected to read and review the bid solicitation documents in order to inform themselves as to the conditions, requirements, and specifications before they submit bids: failure to do so will be at the bidder’s own risk and the bidder cannot secure relief from the plea of error. Generally, neither law nor regulations make allowance for errors either of omission or commission on part of bidders. In case of error in extension of prices in the bid, the unit price shall govern

§ 4.4 MODIFICATION OR WITHDRAWAL OF BID

§ 4.4.1 A Bid may not be modified, withdrawn or canceled by the Bidder during the stipulated time period following the time and date designated for the receipt of Bids, and each Bidder so agrees in submitting a Bid.

§ 4.4.2 Prior to the time and date designated for receipt of Bids, a Bid submitted may be modified or withdrawn by notice to the party receiving Bids at the place designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder. Written confirmation over the signature of the Bidder shall be received, and date- and time-stamped by the receiving party on or before the date and time set for receipt of Bids. A change shall be so worded as not to reveal the amount of the original Bid.

§ 4.4.3 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids provided that they are then fully in conformance with these Instructions to Bidders.

§ 4.4.4 Bid security shall be in an amount sufficient for the Bid as resubmitted.
§ 4.4.5 No Bidder shall modify, withdraw or cancel his Bid, or any part thereof, for sixty (60) days after the receipt of Bids.

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 OPENING OF BIDS
At the discretion of the Owner, if stipulated in the Advertisement or Invitation to Bid, the properly identified Bids received on time will be publicly opened and will be read aloud. An abstract of the Bids may be made available to Bidders.

§ 5.2 REJECTION OF BIDS
The Owner shall have the right to reject any or all Bids. A Bid not accompanied by a required bid security or by other data required by the Bidding Documents, or a Bid which is in any way incomplete or irregular is subject to rejection.

§ 5.2.1 The Owner may make such investigations as he deems necessary to determine the ability of the Bidder to perform the Work, and prospective Bidders may be required to furnish evidence of performance of similar projects of this magnitude and complication and all such information and data as requested. The Owner reserves the right to reject any bid if evidence submitted by, or investigation of, such Bidder fails to satisfy the Owner that such Bidder is properly qualified to carry out obligations of the Contract and to complete the Work contemplated therein.

§ 5.2.2 Conditional Bids will not be accepted.

§ 5.2.3 The Owner also reserves the right to reject the bid of any Bidder who has previously failed to perform properly or complete on time, contracts of a similar nature, who is not in position to perform the contract, or who has habitually and without just cause neglected the payment of bills or otherwise disregarded his obligations to Subcontractors, material, men, or employees. In determining the lowest responsible Bidder the following elements, in addition to those above mentioned, will be considered, whether the Bidder involved:
  1. Maintains a place of business
  2. Has adequate plant equipment to do the work properly and expeditiously,
  3. Has suitable financial status to meet the obligations incidental to the work
  4. Has appropriate technical experience.

§ 5.2.4 The Bidder will be required to establish to the satisfaction of the Owner the reliability and responsibility of the proposed Subcontractors and perform the Work described in the Bidding Documents pertaining to such proposed Subcontractors’ respective trades.

§ 5.3 ACCEPTANCE OF BID (AWARD)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest qualified Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. The Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner’s judgment, is in the Owner’s own best interests. In the event of tie bids where all factors are equal, award shall be made to the Washington County Bidder, the out-of-County Bidder, the Bidder incorporated in Maryland, and the Bidder not incorporated in the state of Maryland, in that order of preference. If bidders within these geographical designations are equal as all factor of consideration the award shall be made by a coin toss.

§ 5.3.2 The Owner shall have the right to accept Alternates in any order or combination and to determine the low Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 CONTRACTOR’S QUALIFICATION STATEMENT
Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request, a properly executed AIA Document A305, Contractor’s Qualification Statement, unless such a Statement has been previously required and submitted as a prerequisite to the issuance of Bidding Documents.

(Paragraphs deleted)
§ 6.3 SUBMITTALS
§ 6.3.1 The Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, after notification of selection for the award of a Contract, furnish to the Owner through the Architect in writing:
1. a designation of the Work to be performed with the Bidder’s own forces;
2. names of the manufacturers, products, and the suppliers of principal items or systems of materials and equipment proposed for the Work; and
3. names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder in writing if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder’s option, (1) withdraw the Bid or (2) submit an acceptable substitute person or entity with an adjustment in the Base Bid or Alternate Bid to cover the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND
§ 7.1 BOND REQUIREMENTS
§ 7.1.1 The Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Bonds may be secured through the Bidder’s usual sources. Firm issuing bonds must be an A-rated or above bond company (A.M. Best rating) and be on the United States Treasury list and be licensed to do business in the State of Maryland.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 If the Owner requires that bonds be secured from other than the Bidder’s usual sources, changes in cost will be adjusted as provided in the Contract Documents.

§ 7.1.4 Bid Bond shall be in the amount of five percent (5%) of the total Bid and shall be submitted with the Washington County Board of Education as the sole obligee and shall be issued for a period of sixty (60) calendar days from the receipt of Bids.

§ 7.1.5 The Contractors Performance Bond and Payment Bond shall be supplied in the amount of 100% of the value of the total contracted work and shall be submitted with the Washington County Board of Education as the sole obligee.

§ 7.1.6 The Owner shall require within ten (10) days after Notice of Award of the Contract, the selected bidder to furnish PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND in the amount of not less than (100%) of the total amount of the contract covering the faithful performance of the Contract and the payment of all obligations arising thereunder in such form and amount as specified in the Specifications. Unless otherwise approved by the Owner, obtain bonds from same surety that furnished bid security. The premiums for said bonds shall be paid by the Bidder. Obtaining of bonds by the selected bidder shall be a condition precedent to effectuation of the Contract between the Owner and the selected bidder.

§ 7.2 TIME OF DELIVERY AND FORM OF BONDS
§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to be commenced prior thereto in response to a letter of intent, the Bidder
§ 7.2.2 The bonds shall be written on AIA Document A312, Performance Bond and Payment Bond. Both bonds shall be written in the amount of the Contract Sum.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney indicating the monetary limit of such power.

ARTICLE 8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR
The Agreement for the Work will be written on AIA Document A101, as amended by the Board of Education of Washington County, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment Is a Stipulated Sum.

ARTICLE 9 MISCELLANEOUS
§ 9.1 OBJECTION OF AWARD
Any company objecting to the RFP procedure or the recommendation for award has five (5) business days following the date of award by the Board of Education to file a written protest with the Superintendent of Schools. It is the company’s responsibility to ascertain and confirm the date/time of the pertinent Board Meeting. The written appeal must be submitted on company letterhead, dated and signed by the senior officer in the company. The protest letter must include a request for review and ruling by WCPS, a detailed statement of the legal and factual grounds for the protest, including the resulting prejudice to the company, copies of relevant documents, and a statement of the form of relief being requested. Failure to comply with these instructions may result in the protest being deemed "not filed." Bid protests received later than five (5) days of the Board Meeting will result in the protest being deemed "not timely." The WCPS will not respond or address bid protests that do not conform to these instructions.

§ 9.2 EMARYLAND MARKETPLACE
All bidders are strongly encouraged to register on the State of Maryland’s eMaryland Marketplace web portal to facilitate WCPS’ compliance to State law. For registration requirements, visit www.emarylandmarketplace.com to join Maryland’s gateway to bidding opportunities throughout the State. Effective June 1, 2008, public school systems in Maryland are required to publish notices of procurements and procurement awards on eMaryland Marketplace. Awards can only be posted to registered companies.
Additions and Deletions Report for
AIA® Document A701™ – 1997

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 16:13:11 on 02/05/2015.

PAGE 1

(Name and location or address):

...

(Name, legal status and address):

Washington County Board of Education
10435 Downsville Pike
Hagerstown, MD 21740

...

(NAME, legal status and address):

...

TABLE OF ARTICLES

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§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201, as modified by the Board of Education of Washington County, or in other Contract Documents are applicable to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect prior to the execution of the Contract which modify or interpret the Bidding Documents, including Drawings and Specifications, by additions, deletions, clarifications or corrections. Addenda will become part of the Contract Documents when the Construction Contract is executed.

...

§ 2.1.5 Generally, neither law nor regulations make allowance for negligent errors either of omission or commission on the part of the bidders. Each Bidder, by making his Bid, represents that he has read and understands the Bidding Documents. Failure of the Bidder to thoroughly understand all aspects of the Solicitation before submitting his Bid will not act as an excuse to permit withdrawal of his Bid nor secure relief on plea of error.

§ 2.1.6 Once the Contract is awarded to the successful Bidder, no claims for any extra work will be allowed because of alleged impossibilities in the production of the results specified, or because of inadequate or improper plans or specifications, and whenever a result is required, the successful Bidder shall furnish any and all extras and make any changes needed to produce, to the satisfaction of the Owner, the required results.
§ 2.1.7 The Bidder shall warrant that no person or selling agency has been employed or retained to solicit or secure the Contract upon an agreement of understanding for a commission or percentage, brokerage or contingent fee excepting bona fide employees or bona fide established commercial or selling agencies maintained by the bidder for the purpose of securing business. For breach or violation of the warrantee the Owner shall have the right to annul the Contract without liability or at its discretion to deduct from the contract price or otherwise recover the full amount of such commission, percentage, brokerage, or contingent.

§ 2.1.8 The Bidder, by the submission of this Bid agrees as a supplier of good, materials, equipment, or services covered by this Bid or the Contract that he will not discriminate in the employment in any way against any person or persons because of their race, creed, color, sex, national origin, age, or handicap. The Owner does not discriminate on the basis of race, color, sex, age, national origin, religion, or disability.

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§ 3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Advertisement or Invitation to Bid in the number and for the deposit sum, if any, stated therein. The deposit will be refunded to Bidders who submit a bona fide Bid and return the Bidding Documents in good condition within ten days after receipt of Bids. The cost of replacement of missing or damaged documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the Bidding Documents and the Bidder’s deposit will be refunded. Either a CD on which all of the Bidding Documents have been scanned or one (1) hard copy set of Bidding Documents will be issued to each bonafide bidder.

... 

§ 3.2.4 Questions shall be in writing and sent to the Owner for interpretation and/or clarification.

... 

§ 3.3.2 No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Bids. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitution would require, shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect’s decision of approval or disapproval of a proposed substitution shall be final. Where less than three (3) manufacturers or products are listed in the Specifications, or the specification lists "Approved Equal" as an acceptable product, the burden of proof of equivalency rests with the Contractor and evidence shall be submitted to the Architect and approved by Architect with final approval to be determined by the Owner. Criteria includes but is not limited to performance, materials, craftsmanship, quality control, certification procedures or requirements, warranty, installation procedures, etc. Any proposed substitution, or proposed equal product, must be submitted to the Architect for review, 10 days prior to the bid date. After the receipt of bids and award of the Contract, the Owner and Architect are under no obligation to review or approve requests for substitution or equal products that were not specifically mentioned in the Specifications. The Owner reserves the right to request a substitute at any time in the project.

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§ 4.1.4 Interlineations, alterations and erasures must be initialed by the signer of the Bid.

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder’s refusal to accept award of less than the combination of Bids stipulated
§ 4.1.8 The contractor or subcontractor shall use or supply American steel products in performance of this Contract in accordance with the Annotated Code of Maryland, State Finance and Procurement Article 17-301 – 17-306 as implemented in the Code of Maryland Regulations (COMAR) 21.11.02.

§ 4.2.1 Each Bid shall be accompanied by a bid security in the form and amount required if so stipulated in the Instructions to Bidders required. The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and will, if required, will furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, bonds, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. The amount of the bid security shall not be forfeited to the Owner in the event the Owner fails to comply with Section 6.2. successful Bidder, upon his failure or refusal to execute and deliver the bonds required in Article 7 within ten (10) days after Notice of Award of the Contract shall forfeit to the Owner, as liquidated damages for such failure or refusal, the security deposited with his Bid.

§ 4.2.1.1 Bid bond shall be in the amount of five percent (5%) of the total Bid and shall be submitted with the Washington County Board of Education as the sole oblige and shall be issued for a period of sixty (60) calendar days from the receipt of Bids.

§ 4.2.2 If a surety bond is required, it Surety bond shall be written on AIA Document A310, Bid Bond, unless otherwise provided in the Bidding Documents. Bond and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney.

§ 4.3.1 All copies of the Bid, the bid security, if any, security and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder’s name and address and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof. Submit the Standard Form of Proposal and required documents in duplicate.

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§ 4.3.6 Upon request of the Owner, Bidders should be prepared to provide a list of major subcontractors after submission of bids and within two (2) business days of the request.

§ 4.3.7 Errors in bids: Bidders or their authorized representatives are expected to read and review the bid solicitation documents in order to inform themselves as to the conditions, requirements, and specifications before they submit bids: failure to do so will be at the bidder’s own risk and the bidder cannot secure relief from the plea of error. Generally, neither law nor regulations make allowance for errors either of omission or commission on part of bidders. In case of error in extension of prices in the bid, the unit price shall govern

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§ 5.2.1 The Owner may make such investigations as he deems necessary to determine the ability of the Bidder to perform the Work, and prospective Bidders may be required to furnish evidence of performance of similar projects of this magnitude and complication and all such information and data as requested. The Owner reserves the right to reject any bid if evidence submitted by, or investigation of, such Bidder fails to satisfy the Owner that such Bidder is properly qualified to carry out obligations of the Contract and to complete the Work contemplated therein.

§ 5.2.2 Conditional Bids will not be accepted.

§ 5.2.3 The Owner also reserves the right to reject the bid of any Bidder who has previously failed to perform properly or complete on time, contracts of a similar nature, who is not in position to perform the contract, or who has habitually and without just cause neglected the payment of bills or otherwise disregarded his obligations to Subcontractors, material, men, or employees. In determining the lowest responsible Bidder the following elements, in addition to those above mentioned, will be considered, whether the Bidder involved:

1. Maintains a place of business
2. Has adequate plant equipment to do the work properly and expeditiously,
3. Has suitable financial status to meet the obligations incidental to the work
4. Has appropriate technical experience.

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§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest qualified Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. The Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner’s judgment, is in the Owner’s own best interests. In the event of tie bids where all factors are equal, award shall be made to the Washington County Bidder, the out-of-County Bidder, the Bidder incorporated in Maryland, and the Bidder not incorporated in the state of Maryland, in that order of preference. If bidders within these geographical designations are equal as all factor of consideration the award shall be made by a coin toss.

§ 5.3.2 The Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, combination and to determine the low Bidder on the basis of the sum of the Base Bid and Alternates accepted.

§ 6.2 OWNER’S FINANCIAL CAPABILITY
The Owner shall, at the request of the Bidder to whom award of a Contract is under consideration and no later than seven days prior to the expiration of the time for withdrawal of Bids, furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner’s obligations under the Contract. Unless such reasonable evidence is furnished, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Bonds may be secured through the Bidder’s usual sources. Firm issuing bonds must be an A-rated or above bond company (A.M. Best rating) and be on the United States Treasury list and be licensed to do business in the State of Maryland.

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§ 7.1.5 The Contractors Performance Bond and Payment Bond shall be supplied in the amount of 100% of the value of the total contracted work and shall be submitted with the Washington County Board of Education as the sole obligee.

§ 7.1.6 The Owner shall require within ten (10) days after Notice of Award of the Contract, the selected bidder to furnish PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND in the amount of not less than (100%) of the total amount of the contract covering the faithful performance of the Contract and the payment of all obligations arising there-under in such form and amount as specified in the Specifications. Unless otherwise approved by the Owner, obtain bonds from same surety that furnished bid security. The premiums for said bonds shall be paid by the Bidder. Obtaining of bonds by the selected bidder shall be a condition precedent to effectuation of the Contract between the Owner and the selected bidder.

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... 

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney indicating the monetary limit of such power.

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ARTICLE 9 MISCELLANEOUS

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Any company objecting to the RFP procedure or the recommendation for award has five (5) business days following the date of award by the Board of Education to file a written protest with the Superintendent of Schools. It is the company’s responsibility to ascertain and confirm the date/time of the pertinent Board Meeting. The written appeal must be submitted on company letterhead, dated and signed by the senior officer in the company. The protest letter must include a request for review and ruling by WCPS, a detailed statement of the legal and factual grounds for the protest, including the resulting prejudice to the company, copies of relevant documents, and a statement of the form of relief being requested. Failure to comply with these instructions may result in the protest being deemed "not filed." Bid protests received later than five (5) days of the Board Meeting will result in the protest being deemed "not timely." The WCPS will not respond or address bid protests that do not conform to these instructions.

§ 9.2 EMARYLAND MARKETPLACE

All bidders are strongly encouraged to register on the State of Maryland’s eMaryland Marketplace web portal to facilitate WCPS' compliance to State law. For registration requirements, visit www.emarylandmarketplace.com to join Maryland’s gateway to bidding opportunities throughout the State. Effective June 1, 2008, public school systems in Maryland are required to publish notices of procurements and procurement awards on eMaryland Marketplace. Awards can only be posted to registered companies.
Certification of Document’s Authenticity
AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 16:13:11 on 02/05/2015 under Order No. 3528535459_1 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A701™ – 1997, Instructions to Bidders, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

(Signed)

(Title)

(Dated)
CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
Washington County Public Schools
10435 Downsville Pike
Hagerstown, MD 21740

BOND AMOUNT: $

PROJECT:
2019-19 Clear Spring Middle School Security Vestibule

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety’s consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor’s bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An Additions and Deletions Report that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.
Signed and sealed this day of ,

(Contractor as Principal) (Seal)

(Witness)

(Title)

(Surety) (Seal)

(Witness)

(Title)
This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 10:58:13 on 01/03/2012.

There are no differences.
Certification of Document’s Authenticity
AIA® Document D401™ – 2003

I, Robert H. Rollins, III, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 10:58:13 on 01/03/2012 under Order No. 4786269459_1 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A310™ – 2010, Bid Bond, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

(Signed)

(Title)

(Dated)
Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the XX day of XXXXX in the year XXXX
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

Board of Education of Washington County
10435 Downsville Pike
Hagerstown, MD 21740

and the Contractor:
(Name, legal status, address and other information)

for the following Project:
(Name, location and detailed description)

Bid 2020-18
Auditorium Renovation / Addition Project
Boonsboro High School
10 Campus Avenue
Boonsboro, MD 21713

The Architect:
(Name, legal status, address and other information)

Bushey Feight Morin Architects
473 N. Potomac Street
Hagerstown, MD 21740

The Owner and Contractor agree as follows:

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An Additions and Deletions Report that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101™-2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201™-2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.
TABLE OF ARTICLES

1  THE CONTRACT DOCUMENTS
2  THE WORK OF THIS CONTRACT
3  DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
4  CONTRACT SUM
5  PAYMENTS
6  DISPUTE RESOLUTION
7  TERMINATION OR SUSPENSION
8  MISCELLANEOUS PROVISIONS
9  Enumeration of Contract Documents

ARTICLE 1  THE CONTRACT DOCUMENTS
The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2  THE WORK OF THIS CONTRACT
The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3  DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[ ] The date of this Agreement.

[ X ] A date set forth in a notice to proceed issued by the Owner.

[ ] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion
§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

[ ] Not later than ( ) calendar days from the date of commencement of the Work.

Init. / 


User Notes:
§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

<table>
<thead>
<tr>
<th>Portion of Work</th>
<th>Substantial Completion Date</th>
</tr>
</thead>
</table>

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor’s performance of the Contract. The Contract Sum shall be ___________________ ($__________) , subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates
§ 4.2.1 Alternates, if any, included in the Contract Sum:

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
</tr>
</thead>
</table>

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement. (Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
<th>Conditions for Acceptance</th>
</tr>
</thead>
</table>

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
</tr>
</thead>
</table>

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

<table>
<thead>
<tr>
<th>Item</th>
<th>Units and Limitations</th>
<th>Price per Unit ($0.00)</th>
</tr>
</thead>
</table>

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

Liquidated damages in the amount of Five Hundred Dollars and no cents ($500.00) per calendar day to apply and shall be assessed against the contractor for delay to both Substantial Completion and Final Completion.

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)
ARTICLE 5 PAYMENTS
§ 5.1 Progress Payments
§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the 1st day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the 15th day of the month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than forty-five (45) days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor’s Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:
   .1 That portion of the Contract Sum properly allocable to completed Work;
   .2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
   .3 That portion of Construction Change Directives that the Architect determines, in the Architect’s professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:
   .1 The aggregate of any amounts previously paid by the Owner;
   .2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017 General Conditions of the Contract for Construction as modified by the Owner;
   .3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
   .4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017 General Conditions of the Contract for Construction as modified by the Owner; and
   .5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage
§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)
Five Percent (5%)  

§ 5.1.7.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017 General Conditions of the Contract for Construction as modified by the Owner.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment
§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when
  .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017 General Conditions of the Contract for Construction as modified by the Owner and to satisfy other requirements, if any, which extend beyond final payment; and
  .2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

§ 5.3 Interest
(Paragraphs deleted)
Paragraph deleted in its entirety.

ARTICLE 6 DISPUTE RESOLUTION
§ 6.1 Initial Decision Maker
The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017 General Conditions of the Contract for Construction as modified by the Owner, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(Paragraphs deleted)
§ 6.2 Binding Dispute Resolution
For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017 General Conditions of the Contract for Construction as modified by the Owner, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[ ] Arbitration pursuant to Section 15.4 of AIA Document A201–2017 General Conditions of the Contract for Construction as modified by the Owner.

[X ] Litigation in a court of competent jurisdiction

[ ] Other (Specify)

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION
§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017 General Conditions of the Contract for Construction as modified by the Owner.

§ 7.1.1 (Paragraphs deleted)
Deleted paragraph.

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017 General Conditions of the Contract for Construction as modified by the Owner.

ARTICLE 8 MISCELLANEOUS PROVISIONS
§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as modified by the Owner and included in the Contract Documents.

§ 8.2 The Owner’s representative:
(Name, address, email address, and other information)

Robert H. Rollins, III, Director – Facilities Planning & Development
Washington County Public Schools
10435 Downsville Pike
Hagerstown, MD 21740

§ 8.3 The Contractor’s representative:
(Name, address, email address, and other information)

§ 8.4 Neither the Owner’s nor the Contractor’s representative shall be changed without ten days’ prior notice to the other party.

§ 8.5 Insurance and Bonds
§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a
Sipulated Sum, Article 11 of AIA Document A201 General Conditions of the Contract for Construction as modified by the Owner and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in Article 11 of AIA Document A201 General Conditions of the Contract for Construction as modified by the Owner – and elsewhere in the Contract Documents.

§ 8.5.3 Certificate of Insurance: Prior to proceeding with the work, the contractor agrees to provide a Certificate of Insurance with theapplication coverage as listed in the Specifications:

List Certificate Holder and Additional Insured as:
Board of Education of Washington County
10435 Downsville Pike
Hagerstown, MD 21740

List the Project as:
Bid 2020-18
Auditorium Renovation/Addition Project
Boonsboro High School
10 Campus Avenue
Boonsboro, MD 21713

§ 8.6
(Paragraphs deleted)
Paragraph deleted

§ 8.7 Other provisions: Minority Business Enterprise ("MBE") Program provisions are not required as part of this contract.

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:
.1 AIA Document A101™—2017, Standard Form of Agreement Between Owner and Contractor
.2 AIA Document A201™—2017, General Conditions of the Contract for Construction
(Paragraphs deleted)
as modified by the Owner.
.3 Specifications dated October 7, 2019 – Exhibit A
.4 Drawings dated October 7, 2019 – Exhibit B
.5 Addendums (if issued) – Exhibit

(Table deleted)

(Paragraphs deleted) Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

This Agreement entered into as of the
(Table deleted)

(Paragraphs deleted)
day and year first written above and is executed in at least three original copies of which one is to be delivered to the Contract one to the Architect for use in the administration of the Contract and the remainder to the Owner.
OWNER (Signature)

Dr. Boud J. Michael, III Superintendent
(Printed name and title)

CONTRACTOR (Signature)

(Printed name and title)
CONTRACT AFFIDAVIT

MANDATORY CONTRACT ADDENDUM

COMAR 21.07.01.25

Bidder shall complete and submit this contract affidavit to the Legal Department of Washington County Public Schools to attach with the contract form.

A. AUTHORITY

I HEREBY AFFIRM THAT:

I, (print name)拥有的法律授权来签署这份宣誓书。

B. CERTIFICATION OF REGISTRATION OR QUALIFICATION WITH THE STATE DEPARTMENT OF ASSESSMENTS AND TAXATION

I FURTHER AFFIRM THAT:

The business named above is a (check applicable items):

Corporation: ___domestic ____or foreign

Limited Liability Company: ___domestic ____or foreign

Partnership: ___domestic ____or foreign

Statutory Trust: ___domestic ____or foreign

Sole Proprietorship: ___and is registered or qualified as required under Maryland Law.

I further affirm that the above business is in good standing both in Maryland and (IF APPLICABLE) in the jurisdiction where it is presently organized, and has filed all of its annual reports, together with filing fees, with the Maryland State Department of Assessments and Taxation. The name and address of its resident agent (IF APPLICABLE) filed with State Department of Assessments and Taxation is:

Name and Department ID Number ____________________________________________

Address: ________________________________________________________________

and that if it does business under a trade name, it has filed a certificate with the State Department of Assessments and Taxation that correctly identifies that true name and address of the principal or owner as:
C. FINANCIAL DISCLOSURE AFFIRMATION

I FURTHER AFFIRM THAT:

I am aware of, and the above business will comply with, the provisions of the State Finance and Procurement Article §13-221, Annotated Code of Maryland, which require that every business that enters into contracts, leases, or other agreements with the State of Maryland or its agencies during a calendar year under which the business is to receive in the aggregate $100,000 or more shall, within 30 days of the time when the aggregate value of the contracts, leases, or other agreements reaches $100,000, file with the Secretary of State of Maryland certain specified information to include disclosure of beneficial ownership of the business.

D. POLITICAL CONTRIBUTION DISCLOSURE AFFIRMATION

I FURTHER AFFIRM THAT:

I am aware of, and the above business will comply with, Election Law Article §§14-101-14-108, Annotated Code of Maryland, which requires that every person that enters into contracts, leases, or other agreements with the State of Maryland, including its agencies or a political subdivision of the State, during a calendar year in which the person receives in the aggregate $100,000 or more shall file with the State Board of Elections a statement disclosing contributions in excess of $500 made during the reporting period to a candidate for elective office in any primary or general election.

E. DRUG AND ALCOHOL FREE WORKPLACE

(Applicable to all contracts unless the contract is for a law enforcement agency and the agency head or the agency head’s designee has determined that application of COMAR 21.11.08 and this certification would be inappropriate in connection with the law enforcement agency’s undercover operations.)

I CERTIFY THAT:

(1) Terms defined in COMAR 21.11.08 shall have the same meanings when used in this certification.

(2) By submission of its bid or offer, the business, if other than an individual, certifies and agrees that, with respect to its employees to be employed under a contract resulting from this solicitation, the business shall:

(a) Maintain a workplace free of drug and alcohol abuse during the term of the contract;

(b) Publish a statement notifying its employees that the unlawful manufacture, distribution, dispensing, possession, or use of drugs, and the abuse of drugs or alcohol is prohibited in the
business’ workplace and specifying the actions that will be taken against employees for violation of the prohibitions;

(c) Prohibit its employees from working under the influence of drugs or alcohol;

(d) Not hire or assign to work on the contract anyone who the business knows, or in the exercise of due diligence should know, currently abuses drugs or alcohol and is not actively engaged in a bona fide drug or alcohol abuse assistance or rehabilitation program;

(e) Promptly inform the appropriate law enforcement agency of every drug-related crime that occurs in its workplace if the business has observed the violation or otherwise has reliable information that a violation has occurred;

(f) Establish drug and alcohol abuse awareness programs to inform its employees about:
   
   (i) The dangers of drug abuse and alcohol abuse in the workplace;
   (ii) The business’s policy of maintaining a drug and alcohol free workplace;
   (iii) Any available drug and alcohol counseling, rehabilitation, and employee assistance programs; and
   (iv) The penalties that may be imposed upon employees who abuse drugs and alcohol in the workplace;

(g) Provide all employees engaged in the performance of the contract with a copy of the statement required by §E(2)(b), above;

(h) Notify its employees in the statement required by §E(2)(b), above, that as a condition of continued employment on the contract, the employee shall:

   (i) Abide by the terms of the statement; and
   (ii) Notify the employer of any criminal drug or alcohol abuse conviction for an offense occurring in the workplace not later than 5 days after a conviction;

(i) Notify the procurement officer within 10 days after receiving notice under §E(2)(h)(ii), above, or otherwise receiving actual notice of a conviction;

(j) Within 30 days after receiving notice under §E(2)(h)(ii), above, or otherwise receiving actual notice of a conviction, impose either of the following sanctions or remedial measures on any employee who is convicted of a drug or alcohol abuse offense occurring in the workplace:

   (i) Take appropriate personnel action against an employee, up to and including termination; or
   (ii) Require an employee to satisfactorily participate in a bona fide drug or alcohol abuse assistance or rehabilitation program; and

(k) Make a good faith effort to maintain a drug and alcohol free workplace through implementation of §E(2)(a)-(j), above.
(3) If the business is an individual, the individual shall certify and agree as set forth in §E(4), below, that the individual shall not engage in the unlawful manufacture, distribution, dispensing, possession, or use of drugs or the abuse of drugs or alcohol in the performance on the contract.

(4) I acknowledge and agree that:
   (a) The award of the contract is conditional upon compliance with COMAR 21.11.08 and this certification;
   (b) The violation of the provisions of COMAR 21.11.08 or this certification shall be cause to suspend payments under, or terminate the contract for default under COMAR 21.07.01.11 or 21.07.03.15, as applicable; and
   (c) The violation of the provisions of COMAR 21.11.08 or this certification in connection with the contract may, in the exercise of the discretion of the Board of Public Works, result in suspension and debarment of the business under COMAR 21.08.03.

F. CERTAIN AFFIRMATIONS VALID

I FURTHER AFFIRM THAT:

To the best of my knowledge, information, and belief, each of the affirmations, certifications, or acknowledgments contained in that certain Bid/Proposal Affidavit dated ________________, 20___, and executed by me for the purpose of obtaining the contract to which this Exhibit is attached remains true and correct in all respects as if made as of the date of this Contract Affidavit and as if fully set forth herein.

I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.

Date: ______________________________

By:

(Print name of Authorized Representative and Affiant)

(Signature of Authorized Representative and Affiant)

(Co Company name)
CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

CONSTRUCTION CONTRACT
Date:
Amount: $  
Description:
(Name and location)

BOND
Date:  (Not earlier than Construction Contract Date)  
Amount: $  
Modifications to this Bond:  
None  
See Section 16

CONTRACTOR AS PRINCIPAL  
(Signature:  
Name and Title:
(Any additional signatures appear on the last page of this Performance Bond.)

SURETY
Company:  
(Corporate Seal)  
(Signature:  
Name and Title:

AGENT or BROKER:

OWNER’S REPRESENTATIVE:
(Architect, Engineer or other party:)

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An Additions and Deletions Report that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.
§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety’s obligation under this Bond shall arise after

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor’s performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner’s notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety’s receipt of the Owner’s notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner’s right, if any, subsequently to declare a Contractor Default;

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

.3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety’s obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety’s expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner’s concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.
§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
.2 additional legal, design professional and delay costs resulting from the Contractor’s Default, and resulting from the actions or failure to act of the Surety under Section 5; and
.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety’s liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.
§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL

Company: ________________________________ (Corporate Seal)
Signature: ________________________________
Name and Title: ____________________________
Address: _________________________________

SURETY

Company: ________________________________ (Corporate Seal)
Signature: ________________________________
Name and Title: ____________________________
Address: _________________________________
Additions and Deletions Report for
AIA® Document A312™ – 2010

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 11:49:30 on 10/09/2012.

There are no differences.
Certification of Document’s Authenticity
AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 11:49:30 on 10/09/2012 under Order No. 5820952305_1 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A312™ – 2010, Performance Bond, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

(Signed)

>Title

(Dated)
Payment Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

CONSTRUCTION CONTRACT
Date:
Amount: $
Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)
Amount: $
Modifications to this Bond: None See Section 18

CONTRACTOR AS PRINCIPAL
Company: (Corporate Seal)
Signature: 
Name and Title:

SURETY
Company: (Corporate Seal)
Signature: 
Name and Title:

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An Additions and Deletions Report that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

AGENT or BROKER:

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

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Init. / User Notes: (1718966249)
§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety’s obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner’s property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety’s expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety’s obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant’s obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety’s expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety’s failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney’s fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety’s total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney’s fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner’s priority to use the funds for the completion of the work.
§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

1. the name of the Claimant;
2. the name of the person for whom the labor was done, or materials or equipment furnished;
3. a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
4. a brief description of the labor, materials or equipment furnished;
5. the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
6. the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
7. the total amount of previous payments received by the Claimant; and
8. the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic’s lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor’s subcontractors, and all other items for which a mechanic’s lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.
§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

<table>
<thead>
<tr>
<th>CONTRACTOR AS PRINCIPAL</th>
<th>SURETY</th>
</tr>
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<tr>
<td>Company:</td>
<td>Company:</td>
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<tr>
<td>(Corporate Seal)</td>
<td>(Corporate Seal)</td>
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<td>Signature:</td>
<td>Signature:</td>
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<td>Name and Title:</td>
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Additions and Deletions Report for
AIA® Document A312™ – 2010

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Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 11:43:03 on 10/09/2012.

There are no differences.
Certification of Document’s Authenticity
AIA® Document D401™ – 2003

I, [Name], hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 11:43:03 on 10/09/2012 under Order No. 5820952305_1 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A312™ – 2010, Payment Bond, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

(Signed)

>Title

(Dated)
TO OWNER: Washington County Public Schools 82 Commonwealth Avenue Hagerstown, MD 21740

FROM CONTRACTOR: VIA ARCHITECT:

APPLICATION'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract. Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM .......................................................... $ ........................................ 0.00
2. Net change by Change Orders .......................................................... $ ........................................ 0.00
3. CONTRACT SUM TO DATE (Line 1 ± 2) ............................................. $ ........................................ 0.00
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703) ....... $ ........................................ 0.00
5. RETAINAGE:
   a. 0 % of Completed Work
      (Column D + E on G703) ........................................ $ 0.00
   b. 0 % of Stored Material
      (Column F on G703) ........................................ $ 0.00
      Total Retainage (Lines 5a + 5b or Total in Column I of G703) ........... $ ........................................ 0.00
6. TOTAL EARNED LESS RETAINAGE ................................................. $ ........................................ 0.00
   (Line 4 Less Line 5 Total)
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT ................................ $ ........................................ 0.00
   (Line 6 from prior Certificate)
8. CURRENT PAYMENT DUE ............................................................... $ ........................................ 0.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE ................................ $ ........................................ 0.00
   (Line 3 less Line 6)

CHANGE ORDER SUMMARY

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<td>Total approved this Month</td>
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<td>NET CHANGES by Change Order</td>
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</table>

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED ................................................................. $ 0.00

(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

ARCHITECT: By: ................................................ Date: ..............

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.
**Continuation Sheet**

AIA Document G702, APPLICATION AND CERTIFICATION FOR PAYMENT, containing Contractor's signed certification is attached.

In tabulations below, amounts are stated to the nearest dollar.

Use Column I on Contracts where variable retainage for line items may apply.

<table>
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<tr>
<th>ITEM NO.</th>
<th>DESCRIPTION OF WORK</th>
<th>SCHEDULED VALUE</th>
<th>WORK COMPLETED FROM PREVIOUS APPLICATION ((D + E))</th>
<th>WORK COMPLETED THIS PERIOD</th>
<th>MATERIALS PRESENTLY STORED (NOT IN D OR E)</th>
<th>TOTAL COMPLETED AND STORED TO DATE ((D + E + F))</th>
<th>(%) ((G ÷ C))</th>
<th>BALANCE TO FINISH ((C - G))</th>
<th>RETAINAGE RATE (IF VARIABLE RATE)</th>
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<th>PERIOD TO:</th>
<th>ARCHITECT'S PROJECT NO:</th>
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</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>
Certificate of Substantial Completion

PROJECT: [Name and address]
PROJECT NUMBER: [ ]
CONTRACT FOR: General Construction
CONTRACT DATE: [ ]

TO OWNER: [Name and address]
TO CONTRACTOR: [Name and address]

PROJECT OR PORTION OF THE PROJECT DESIGNATED FOR PARTIAL OCCUPANCY OR USE SHALL INCLUDE:

The Work performed under this Contract has been reviewed and found, to the Architect’s best knowledge, information and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion designated above is the date of issuance established by this Certificate, which is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:

Warranty Date of Commencement

ARCHITECT [Name and address] BY [Name and address] DATE OF ISSUANCE [Date]

A list of items to be completed or corrected is attached hereto. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment.

Cost estimate of Work that is incomplete or defective: $0.00

The Contractor will complete or correct the Work on the list of items attached hereto within Zero (0) days from the above date of Substantial Completion.

CONTRACTOR [Name and address] BY [Name and address] DATE [Date]

The Owner accepts the Work or designated portion as substantially complete and will assume full possession at [date] on [time].

OWNER [Name and address] BY [Name and address] DATE [Date]

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance shall be as follows:
(Note: Owner’s and Contractor’s legal and insurance counsel should determine and review insurance requirements and coverage.)
for the following PROJECT:
(Name and location or address)

Bid – 2020-18
Auditorium Renovation / Addition Project
Boonsboro High School
10 Campus Avenue
Boonsboro, MD 21713

THE OWNER:
(Name, legal status and address)

Board of Education of Washington County
10435 Downsville Pike
Hagerstown, MD 21740

THE ARCHITECT:
(Name, legal status and address)

Bushey, Feight, Morin Architects
473 N. Potomac Street
Hagerstown, MD 21740

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An Additions and Deletions Report that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

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For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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ARTICLE 1  GENERAL PROVISIONS
§ 1.1 Basic Definitions
§ 1.1.1 The Contract Documents
The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor’s bid or proposal, or portions of Addenda relating to bidding or proposal requirements. Written material incorporated within the Agreement shall have precedence, and shall supersede conflicting requirements of the other Contract Documents. However, this provision shall apply only where such written material is explicit and clearly and fully enumerated within the Agreement, all provisions of various Contract Documents shall remain in force; notwithstanding all prior negotiations, representations, or agreements, either written or oral, including the Bidding Documents.

§ 1.1.2 The Contract
The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect’s consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect’s consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect’s duties.

§ 1.1.2.1 The Contract documents shall be signed by the Owner and Contractor. If either the Owner or Contractor or both do not sign all the Contract Documents, the Architect shall identify such unsigned Documents upon request.

§ 1.1.3 The Work
The term “Work” means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor’s obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project
The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings
The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications
The Specifications are the portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.6.1 The Project Manual
The Project Manual is a volume assembled for the Work which may include the bidding requirements, sample forms, Conditions of the Contract and Specifications.

§ 1.1.7 Instruments of Service
Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect’s consultants under their
respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker
The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.1.9 Addenda
Addenda are written or graphic instructions issued prior to the execution of the Contract which modifies or interprets the Bidding Documents, including Drawings, Project Manual, or Specifications, by additions, deletions, clarifications, or corrections. Addenda will become part of the Contract Documents when the Construction Contract is executed.

§ 1.2 Correlation and Intent of the Contract Documents
§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 It is the responsibility of each Bidder, Contractor and Subcontractor to familiarize himself/herself with the provisions of the Contract Documents.

§ 1.2.1.2 Alleged conflicts or ambiguities shall be brought to the attention of the Architect, in writing, prior to Proposal submission. The Architect shall then issue a written interpretation, in the form of an Addendum, addressing the area(s) in question.

§ 1.2.1.3 Should an alleged conflict or ambiguity be discovered after Proposal submission, it is hereby agreed that the Contractor and/or Subcontractor estimated the work on the provisions and interpretations as directed by the Architect. It is understood that these provisions shall not require the performance of any work unless such work is covered within the Contract Documents or is reasonably inferable therefrom as being necessary to produce the intended results.

§ 1.2.1.4 If in the language of the Contract Documents it is alleged that certain provisions, words, phrases, and sentences may be considered unclear, equivocal, conflicting or ambiguous, it is understood and agreed, under the Contract, that they shall be interpreted by the Architect based on complementary provisions of all documents, the context of the item in question, and the intent of the Architect.

§ 1.2.1.5 Where any item of work or piece of equipment is referred to in the singular, it shall be deemed to apply to as many such items or pieces of equipment as required for a complete installation.

§ 1.2.1.6 Verbs such as include, provide, install, perform, apply, construct, supply, erect or similar words contained within the Contract Document are comprehensive actions to be performed by Contractor.

§ 1.2.1.7 The term “noted” or “as indicated” shall mean as shown, indicated or noted on the Drawings or in the Specifications or on any other Contract Document.

§ 1.2.1.8 The term “typical” means a representative example to be repeated in all similar situations. However, minor variations where necessary to adapt the typical item to a specific situation shall be included.

§ 1.2.1.9 Where reference is made to a text, standard, federal specifications, manufacturer’s directions, or to other publication, the latest publication published prior to the date of issuance of Contract Documents shall apply, unless identified in Specification by a specific publication date.

§ 1.2.1.10 Locations, sizes, and depth of existing services (i.e. manholes, utilities, etc.) are indicated are based on

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records made available by the utility companies and/or the authorities having jurisdiction. Under the work of each applicable section, examine the premises and verify visible, existing conditions prior to proposal submission and the starting of work.

§ 1.2.1.11 Drawing indications of items are generally diagrammatic. Connection and anchorage of materials, interconnection of equipment and accessories necessary to any system operation not otherwise detailed or specified shall be selected under the work of each section, subject to Architect’s approval, to suit the requirements of the items.

§ 1.2.1.12 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties’ intentions and purposes in executing the Contract.

§ 1.2.2 The organization of the Specifications into divisions, sections and paragraphs, and the arrangement of the Drawings shall in no way be construed to control or limit the manner in which the Contractor performs the work among his Subcontractors, nor shall they relieve the Contractor of his responsibility to perform the work, drawn and/or specified, in its entirety.”

§ 1.2.2.1 Wherever in the Specifications there appears a reference to a “Contractor” or to the “Subcontractor” or a reference to a contractor, installer or supplier of a particular trade, or for a particular type of Work, such reference, regardless of the language thereof, shall be deemed a reference to the Contractor. It shall not be construed as relieving the Contractor from the duty to perform all of the Work and other obligations provided under this Contract.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.2.4 Computed dimensions shall take precedence over scaled dimensions and large scale drawings shall take precedence over small scale drawings. The drawings are intended to show the general arrangement, design and extent of the Work, and are partly diagrammatic; they are not to be scaled or used in lieu of shop drawings where required.

§ 1.2.5 Should the Drawings conflict with themselves, or with the Specifications, the better quality or greater quantity of Work or materials shall be used for the purpose of bidding and, unless otherwise ordered in writing, shall be provided.

§ 1.2.6 Where typical or representative detail is shown on the drawings, this detail shall constitute the standard in workmanship and materials throughout corresponding parts of the Work and, when necessary, the Contractor shall be required to adapt such detail for use in said corresponding parts of the Work, said adaptation however, shall be subject to the consent of the Architect.

§ 1.3 Capitalization
Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation
In the interest of brevity, the Contract Documents frequently omit modifying words such as “all” and “any” and articles such as “the” and “an,” but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service
§ 1.5.1 The Architect and the Architect’s consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or
distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect’s or Architect’s consultants’ reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect’s consultants.

§ 1.6 Notice
§ 1.6.1 Except as otherwise provided in Section 1.6.2, the Contract Documents require one party to notify or give notice to the party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement. It

§ 1.6.2 Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended, or if delivered at or sent by registered or certified mail to the last business address known to the party giving notice.

§ 1.6.3 All proposals, approvals, instructions, requests, claims, demands and other notices shall be made in writing on Contractor’s stationary; meeting minutes and facsimile transmission will not be considered written notice.

§ 1.7 Digital Data Use and Transmission
The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™-2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance
Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™-2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™-2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party’s sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER
§ 2.1 General
§ 2.1.1 The Owner is the Board of Education of Washington County identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term “Owner” means the Owner or the Owner’s authorized representative.

Where the word “Architect” occurs in these specifications, it shall be taken to designate either Architect or Engineer.

§ 2.1.2 The Contractor understands that the Board of Education of Washington County is a public agency and no mechanics liens are permitted against its property.

(Paragraph Deleted)

§ 2.2 Paragraph deleted in its entirety.

§ 2.3 Information and Services Required of the Owner
§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term, “Architect” means the Architect or Architect’s authorized representative.

§ 2.3.3 If the employment of the Architect terminates, the Owner can choose to employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site to the extent reasonably required for the execution of the Work. Surveys shall be requested by the Contractor in writing within one (1) month of the date of the Contract. The Owner does not warrant or undertake responsibility for the location of utilities or the accuracy of tests concerning the soil, surface, and subsurface conditions.

§ 2.3.5 Information or services under the owner's control shall at the Contractor's written request be furnished by the Owner with reasonable promptness to avoid delay in orderly progress of the Work.

§ 2.3.6 The Contractor is responsible for obtaining and maintaining their own copies of Drawings and Project Manuals as necessary for execution of the Work.

§ 2.4 Owner's Right to Stop the Work

§ 2.4.1 If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or persistently fails to carry out Work in accordance with the Contract Documents, the Owner, by written order signed personally or by an agent specifically so empowered by the Owner in writing, may order the Contractor to stop the Work, or any portion thereof, without additional charge, claim, or penalty until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity. This right shall be in addition to and not in restriction or derogation of the Owner's rights under Section 4.3.4.

§ 2.4.2 If unforeseen conditions occur or are encountered which may substantially impair the quality of the Work unless the Work is suspended, the Owner may suspend the Work by written notice to the Contractor. In the event of such a suspension, Contractor shall be entitled to only adjustments in the Contract Time and an adjustment in the Contract Sum for costs actually incurred at the Project site due to reason of such suspension. In any event where the Contractor reasonably determines that a suspension is required in such circumstances the Contractor shall promptly provide written notification to the Owner, and Architect of such determination.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may after such seven-day period without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Owner, and Architect's and their respective consultants' additional services and expenses made necessary by such default, neglect or failure. If payment is then or thereafter due the Contract are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.
ARTICLE 3 CONTRACTOR
§ 3.1 General
§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term “Contractor” means the Contractor or the Contractor’s authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect’s administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor
§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents. The Contractor warrants that it has made itself familiar with the project site, including soils, surface and subsurface conditions and the location of utilities, and the improvements to be constructed.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor’s review is made in the Contractor’s capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents. General information of existing conditions is available in the project manual.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 Paragraph deleted in its entirety.

§ 3.3 Supervision and Construction Procedures
§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor’s best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the job site safety thereof and shall be solely responsible for the job site safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor’s proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.1.1 Any construction means, methods, techniques, sequences, and procedures specified within the Contract Documents are to establish minimum standards only.
§ 3.3.1.2 Nothing contained within the contract Documents shall be construed as limiting the contractor's sole responsibility under this Article.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.3.3.1 All inspections required by law shall be obtained by the Contractor including but not limited to those required by law to be obtained by the Owner. No failure of the Owner to obtain such inspection shall constitute a waiver of Contractor's obligation hereunder. The Contractor shall notify the Owner of any application for inspection required to be executed by the Owner.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 If the specification has listed three (3) or more product lines, substitutions will not be considered. Where less than three (3) manufacturers or products are listed in the Specifications, or the specification lists “Approved Equal” as an acceptable product, the burden of proof of equivalency rests with the Contractor and evidence shall be submitted to the Architect and approved by the Architect with final approval to be determined by the Owner. Criteria includes by not limited to performance, materials, craftsmanship, quality control, certification procedures or requirements, warranty, installation procedures, etc. Any proposed substitution, or proposed equal product, must be submitted to the Architect for review, 10 days prior to the bid date. After the receipt of bids and award of the Contract, the Owner and Architect are under no obligation to review or approve requests for substitution or equal products that were not specifically mentioned in the Specifications. The Owner reserves the right to request a substitute at any time during the project.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them. The Contractor shall at all times be in control of the work and shall be responsible for the safety of his employees, subcontractors, sub-subcontractors, and their employees.

§ 3.4.4 Not later than ten (10) days from the Contract Date, the Contractor shall provide to the Architect and the Owner a list showing the name and the manufacturer proposed to be used for each of the products identified in the Specification, and where applicable, the name of the installing Subcontractor.

§ 3.4.5 The Architect will promptly reply in writing to the Contractor stating whether the Owner or the Architect, after due investigation, has reasonable objection to the list described in 3.4.4. If adequate data on any proposed manufacturer or installer is not available, the Architect may state that action will be deferred until the Contractor provides further data. Failure of the Owner or Architect to reply promptly shall not constitute notice of no reasonable objection. Acceptance of a substitute manufacturer must conform to such requirements.

§ 3.4.6 By making request for substitutions based on Clause 3.4.2 above, the Contractor; (a) represents that he has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified; (b) represents that he will provide the same warranty for the substitution that he would for that specified; (c) certifies that the cost data presented is complete and includes all related costs under his Contract, but excluded additional costs related to the substitution which subsequently become apparent; and (d) will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.

§ 3.4.7 By law, all school sites are drug, alcohol and tobacco free.
§ 3.4.8 All products intended for use on this project shall be free of asbestos containing material in compliance with Local, State and Federal laws and regulations.

§ 3.4.9 All materials intended for use on this project shall be lead free. This requirement applies to all coatings, including materials applied at the place of fabrication or in the field.

§ 3.5 Warranty
§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects, and that the Work will conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment used.

§ 3.5.1.1 Provisions of these Contract Documents, including specified guarantees, shall not limit the extent of nature of any warranty or guarantee under the law; or limit the extent or nature of other warranty or guarantee provisions either express or implied including warranties of merchantability or fitness for particular use.

§ 3.5.1.2 Any Contract or Purchase pertaining to this project shall provide the Owner as ultimate user, with the right to all warranties and guarantees.

§ 3.5.1.3 No Contract or Purchase pertaining to this project shall allow for waiver of warranties or guarantees.

§ 3.5.1.4 Except as provided by the technical Specification Sections, each Contractor shall warrant all materials, workmanship and equipment against original defects or against injury from property and usual wear for a period of not less than two (2) years from the date of Substantial Completion of the project or designated portion thereof and shall repair or replace, at no additional cost to the Owner, any item which may become defective within the warranty period. Any exceptions or additions to this Paragraph are noted in the technical Specifications Sections. This Paragraph shall in no way limit the Contractor's obligation to warrant the work as identified in any other provisions of the Contract Documents.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes
§ 3.6.1 The Contractor shall pay sales, consumer, use and similar taxes for Work, or portions thereof, provided by the Contractor which are legally enacted when bids are received whether or not yet effective or merely scheduled to go into effect.

§ 3.6.1.1 Contractor shall pay all costs associated with the performance of the work.

§ 3.7 Permits, Fees, Notices and Compliance with Laws
§ 3.7.1 Unless otherwise provided in the Contract Documents, the Owner shall secure and pay for the building permit and the Contractor shall secure and pay for all other permits and governmental fees, licenses and inspections necessary for proper execution and completion of the Work which are customarily secured after execution of the Contract and which are legally required when bids are received. Provisions of this Paragraph shall apply to all items of work both permanent and temporary. The Owner will not reimburse the Contractor for the cost of elective permits which the Contractor chooses to secure in conjunction with his means and methods of executing the work or for any off-site permits. All permit fees not waived by the Governing Authorities will be reimbursed to the Contractor by the Owner with no mark up of overhead, profit, or bond to the Contractor. The Owner will responsible for payment of all fees associated with the set-up of permanent utilities.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.
§ 3.7.3 The Contractor shall review the Contract Documents to ascertain that the Contract Documents are to the best of the Contractor's knowledge in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations. The Contractor shall promptly notify the Architect and Owner in writing, of any variance therewith and necessary changes shall be accomplished by appropriate Modification.

§ 3.7.3.1 If the Contractor performs Work knowing it to be contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Architect and Owner, the Contractor shall assume full responsibility for such Work and shall bear the attributable costs.

§ 3.7.4 Concealed or Unknown Conditions
If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If the contractor disputes the Architect's determination or recommendation, of an equitable adjustment or that no change is justified, it may submit a Change Order Proposal for consideration. If the Owner disputes the Architect's determination, it may request a Change Order Proposal from the Contractor, or issue a Construction Change Directive.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances
§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as acceptable to the Owner, but the Contractor shall not be required to employ persons or entities against which the Contractor makes reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,
.1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
.2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
.3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent and Other On-Site Personnel
§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.
§ 3.9.2 Within five (5) days following the award of the contract, the Contractor shall furnish to the Owner a detailed resume of the proposed project manager, superintendent and assistant superintendent for the project. The Owner may make such investigations as he deems necessary to determine the qualifications of the proposed persons to perform their duties, and the Contractor shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject the candidates if the evidence submitted by or investigation of, the Contractor fails to satisfy the Owner that they are qualified to perform the duties.

§ 3.9.3 An experienced project manager must be assigned to this project. His duties generally are to set schedules, to coordinate with the Architect’s office and the field, to expedite subcontractors, to handle paperwork, to represent the Contractor in meetings and to maintain documentation in a timely manner. Communicating with the Architect and the Owner is an extremely important part of this job. If the project manager does not maintain the prompt performance of his duties, the Owner can direct the replacement and the approval of personnel for this position.

§ 3.9.4 The position of superintendent is to one of the managing the Work on site and generally not to assist in any of the physical construction work. His duties are to coordinate, plan, problem solve, and keep the Work on schedule. He shall have an assistant superintendent who is at the work observing the subcontractors, anticipating material needs and to assist the superintendent as required. He also will be in charge and performing any other duties when the superintendent is absent. No work shall be done without one of these personnel there at the Work site including weekends, evenings, and holidays.

§ 3.9.5 If the above personnel do not perform their duties to the Owner’s satisfaction, the Owner may order him replaced and the Contractor shall comply therewith. No claim will be allowed for actions by the Owner under this provision.

§ 3.9.6 The Contractor shall coordinate and supervise the work of the subcontractors to the end so that the Work is carried out without conflict between trades and so that no trade, at any time, causes delay to the general progress of the work. The Contractors and Subcontractors shall at all times afford each trade, any separate Contractor, or the Owner, every reasonable opportunity for the installation of work and the storage of materials.

§ 3.9.7 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner’s consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor’s Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner’s and Architect’s information a Contractor’s construction schedule for the Work in accordance with the Specifications. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.1.1 The Contractor shall revise and update construction schedule for the Work on a monthly basis, and submit to Owner and Architect. The Construction Schedule shall give accurate representation to the entire Project, for all completed current, and planned activities within scope of Project, and include all respective dates.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect’s approval. The Architect’s approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor’s construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.
§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site
The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in such order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.11.1 This shall be completed prior to final payment and shall be executed by the Contractor certifying that they have been kept in accordance with the provisions of this subparagraph and accurately reflect the construction of the Work as built. In addition to one copy of Drawings, Specifications, Addenda, Shop Drawings, Change Orders and Modifications, the Contractor shall maintain one additional set of Contract Documents to be used solely as a record for the future preparation of “As-Built” drawings. The Contractor shall record all changes and departures from the Contract Documents (floor plans, site plans, ceiling plans, etc.) and the correct locations of concealed work, recording them in red ink on the Documents maintained for this purpose. Recording shall be made immediately after each item of work is completed. At the completion of the Project and before a final payment is made, the Contractor shall deliver these documents to the Architect.

§ 3.12 Shop Drawings, Product Data and Samples
§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment or systems for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors. Submittals which are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.
§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance or design criteria required by the contract documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.12.11 Submittal review times listed in the Contract Documents are the minimum review time per submission. The Architect is not obligated to approve submittals on the first submission or any subsequent submission if the submittals are incomplete or require revision. It is the responsibility of the Contractor to schedule submittals well in advance of order and delivery times, allowing a reasonable variance in review time and the possibility of revisions and resubmission.

§ 3.13 Use of Site
The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.13.2 The Contractor shall assume responsibility for all of its construction activities on the site. All employees, subcontractors, sub-subcontractors, and material suppliers of the Contractor shall be bound by the directions of the Contractor pertaining to disposition of materials and equipment on the site and precautions necessary for protection of life and property. The Contractor shall be responsible for and shall maintain continuous access to the work for use by all contractors, employees, subcontractor, sub-subcontractors, and material suppliers.
§ 3.14 Cutting and Patching
§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.14.3 No Contractor shall cut structural members except with written permission of the Owner and Architect.

§ 3.15 Cleaning Up
§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor’s tools, construction equipment, machinery, and surplus materials from and about the Project. The Contractor shall on a daily basis, police and keep clean the site and surrounding areas of the project of his materials, rubbish, tools, construction equipment, machinery, or any materials to be stored thereon, either temporarily or permanently.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work
The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights
The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturer is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification
§ 3.18.1 To the fullest extent permitted by law, and to the extent claims, damages, losses or expenses are not covered by Project Management Protective Liability insurance purchased by the Contractor in accordance with Section 11.3, the Contractor shall indemnify, protect, defend and hold harmless the Owner, Architect, Architect’s consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorney’s fees, arising out of or resulting from performance of the Work caused in whole or in part by acts or omissions of the Contractor, a subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity, which would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers’ compensation acts, disability benefit acts, or other employee benefit acts.
§ 3.18.3 The obligations of the Contractor under this section 3.18 shall not extend to the liability of the Architect, their consultants, and agents and employees of any of them arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications, or (2) the giving of, or the failure to give, direction or instructions by the Architect, their consultants, and agents and employees of any of them provided such giving or failure to give is the primary cause of the injury or damage and provided that the giving of such instruction is usual and customary as otherwise herein defined.

§ 3.18.4 The Contractor agrees to perform the Work in a safe and proper manner and comply with all laws and Ordinances referring to such Work, and to indemnify and save the Owner, his respective agents, consultants, servants, and employees (hereinafter the “Indemnities”) Such indemnity, as used in this Article, includes the defense of claims, made against the Indemnities and all penalties for violation of the same.

§ 3.18.5 The purchase of insurance by the Contractor shall in no event be construed as a fulfillment or discharge of the obligations set forth in this section.

§ 3.18.6 To the fullest extent permitted by Law, the Contractor shall properly guard its Work and areas affected from being injured by it or by the condition of the Project Site, and shall in all respects comply with any and all provisions of the law and local ordinances relating to the maintenance of danger signals, barriers, lights, and similar safeguards respecting falling materials and in and about all excavations, protruding nails, hoists, openings, scaffolding, stairways and other parts of the work and adjacent area where the same are required. The Contractor agrees to indemnify, defend and save harmless the Indemnities against loss and expense by reason of liability imposed by law upon the Indemnities for damages because of bodily injuries including death at any time resulting therefrom, sustained by any person or persons other than employees of the Contractor, whether or not the Indemnities are negligent in such event.

§ 3.18.7 To the fullest extent permitted by law, the Contractor shall agree to indemnify, defend and save harmless the Indemnities against loss and expense by reason of the liability imposed by law upon the Indemnities for damages because of bodily injuries, including death at any time resulting therefrom, sustained by any employee of the Contractor while at the site where Work under this Contract is conducted, or elsewhere, while engaged in the performance of Work, under this contract. The Contractor will not indemnify the Indemnities’ sole or concurrent negligence, whether attributable to a breach of statutory duty, or administration regulation, or otherwise.

§ 3.18.8 The Contractor agrees to indemnify and hold the Indemnities harmless by reason of any liens, claims demands or other liability, which may be asserted against the Indemnities by any other Independent Contractor on the Project, and which arise out of any act or omission of the Contractor.

§ 3.18.9 In the event of any such liability, loss expense, damage or injury, or if any claim or demand for damage is made against the Indemnities, the Owner may withhold from any payment due or thereafter to become due to the Contractor under the terms of this Contract, an amount sufficient in its judgment to protect and indemnify Indemnities for any and all such claims, liability expense, loss, damage or injury; or the Owner, in its sole decision may require the Contractor to furnish a surety bond satisfactory to the Owner, guaranteeing such protection, which bond shall be furnished by the Contractor within five (5) days written demand had been made thereafter.

§ 3.18.10 The indemnification obligation of the Contractor under this Article 3 shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefit payable by or for the Contractor or any Subcontractor under Workman’s Compensation Acts, disability Benefits Acts or other employee benefits Acts.

§ 3.18.11 The Owner will obtain and pay for, if necessary, the general building permit, post applicable utility bonds and pay access fees and right of way fees. The Contractor will arrange and pay for the cost of all other “trade” permits, approvals and inspections. The Contractor will be responsible for notifying all agencies to schedule inspections or approvals, whether permits or fees are in the Contractor’s or the Owner’s responsibility.
§ 3.18.12 Contractor shall not place any signs, billboards or poster on any portion of the project site, building property or fences (temporary or permanent) surrounding the same, unless prior written permission has been received from the Owner, and then only of a size, material, color and type and a location approved by the owner.

§ 3.18.13 The Contractor shall be responsible for implementing safety programs for his own forces and those of his/her subcontractors in accordance with Federal, State, and local requirements. In addition to other indemnities contained herein the Contractor agrees to indemnify and hold harmless against any and all damages, claims and losses, the Owner and/or Architect from any and all damages, claims and losses made as a result of Contractor’s failure to abide by this provision, the Contract and for any and all safety and health (including but not limited to OSHA, MSHS, and VOSH) claims or violations that are alleged or brought. Said indemnification shall include but not be limited to Owner’s and/or Architect’s attorney’s fees and costs.

ARTICLE 4 ARCHITECT
§ 4.1 General
§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract
§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents, and will be an Owner’s representative (1) during construction (2) until final payment is due and (3) with the Owner’s concurrence, from time to time during the one-year period for correction of Work described in Section 12.2. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified in writing in accordance with other provisions of the Contract.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor’s rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor’s failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications
The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect’s services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect’s consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.
§ 4.2.5 Based on the Architect’s evaluations of the Contractor’s Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither of authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor’s submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect’s action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect’s professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect’s review of the Contractor’s submittals shall not relieve the Contractor of the obligations under Sections 3.3 and 3.12. The Architect’s review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures, unless otherwise specifically stated by the Architect. The Architect’s approval of a particular item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner’s review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect’s responsibilities at the site. The Architect shall notify the Owner and Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect’s response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If no agreement is made concerning the time within which interpretations required of the Architect shall be furnished in compliance with this Section 4.2, then delay shall not be recognized on account of failure by the Architect to furnish such interpretations until 15 days after written request is made for them.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings.

§ 4.2.13 The Architect’s decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents and acceptable to the Owner.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect’s response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.
ARTICLE 5  SUBCONTRACTORS
§ 5.1 Definitions
§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term “Subcontractor” is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term “Subcontractor” does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term “Sub-subcontractor” is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work
§ 5.2.1 Unless otherwise stated in the Contract Documents, or bidding requirements, the Contractor, as soon as practicable after award of the Contract, but not later than 48 hours after requested by the Owner, shall notify in writing, the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor’s Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsibly in submitting names as required.

§ 5.2.4 The Contractor shall not change a Subcontractor, person or entity previously selected without approval of the Owner.

§ 5.2.5 If the Contractor fails to submit names of persons or entities to whom the Owner and Architect has no reasonable objection within a reasonable amount of time, the Contract may be terminated by the Owner.

§ 5.2.6 The Contractor shall not be entitled to progress payments prior to approval of the persons or entities as provided in Subparagraph 5.2.1.

§ 5.3 Subcontractual Relations
By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor’s Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound; and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will
similarly make copies of applicable portions of such documents available to their respective proposed Subcontractors.

§ 5.4 Contingent Assignment of Subcontracts
§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2, or stoppage of the Work pursuant to Subparagraph 14.2.3 and only for those subcontract agreements which the Owner accepts by notifying the Subcontractor in writing; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor’s rights and obligations under the subcontract.

§ 5.4.2 Paragraph deleted in its entirety.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
§ 6.1 Owner’s Right to Perform Construction and to Award Separate Contracts
§ 6.1.1 The term “Separate Contractor(s)” shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner’s own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term “Contractor” in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner’s own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Paragraph deleted in its entirety.

§ 6.2 Mutual Responsibility
§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor’s construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor’s Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor’s Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner’s or Separate Contractor’s completed or partially completed construction is fit and proper to receive the Contractor’s Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.
§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor’s delays, improperly timed activities or defective construction of the Contractor. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor’s delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage caused by the Contractor to completed construction or partially completed construction or to property of the Owner or other Contractors as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.2.6 Should the Contractor be caused damage by a separate Contractor, no action will lie against the Owner and the owner shall have no liability therefor, but the contractor may assert his claim for damages against Contractor as the third party beneficiary under the Contract between the Contractor and the owner. Should Contractor make a claim against the Owner or Architect on account of damages alleged to have been so sustained, such the Contractor agrees that he/she will reimburse to the Owner or Architect as the case may be, the cost of defending such suit, including reasonable attorney’s fees, and if any judgment against the Owner or Architect arises therefrom the Contractor shall pay or satisfy it and shall pay all costs incurred by the Owner or Architect.

§ 6.2.7 Upon entering the project, the Contractor shall locate all general reference points provided, and take such action as necessary to prevent their destruction.

§ 6.2.8 Under the work of each Contractor, subcontractor, and all personnel. Lay out work and be responsible for all lines, levels, elevations, and measurements from points provided. The Contractor shall exercise proper precautions to verify conditions indicated in the Contract Documents and be responsible for any error resulting from failure to exercise such precaution.

§ 6.3 Owner’s Right to Clean Up
If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7  CHANGES IN THE WORK
§ 7.1 General
§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall not release the Contractor of obligations under the contract and shall be based upon agreement among the Owner, Contractor and Architect; A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.1.4 Except in any emergency which might endanger life or property, no extra work or charge shall be made unless a written change order from the Owner and/or Architect has been received by the Contractor.

§ 7.2 Change Orders
§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

.1 The change in the Work;
.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.
§7.2.2 Methods used in determining adjustments to the Contract Sum may include those listed in Section 7.3.3.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may, by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, with the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order or in the event that full execution of a Change Order may cause undue delay to the work.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

1. Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
2. Unit prices stated in the Contract Documents or subsequently agreed upon;
3. Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
4. As provided in Section 7.3.6.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in Contract Sum, the method and the adjustment shall be determined by the Architect on the basis of reasonable expenditures and savings of those performing the work attributable to the change, including an allowance for overhead and profit in accordance with the schedule set for in Paragraph 7.3.4.5 below. In such case, and also under Clause 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

(Paragraph Deleted)

All change Orders shall be subject to the following format for itemization of the costs:

1. Attach an itemization of labor hours. A certified payroll affidavit may be required to substantiate labor rates. The cost of foremen and superintendents may be added only when the change order makes necessary the hiring of additional supervisory personnel or makes their employment for time in addition to that required by the basic contract, or if the foremen or superintendent participates in the actual work of the Change Order.

2. Labor burden percentage costs shall include all fringe benefits, taxes, insurance, liabilities, workmen’s compensation and unemployment. Labor burden percentage rates are subject to approval of the Owner and are not subject to profit and overhead.

3. Attach an itemization of all materials used listing unit prices and extended prices.

4. Attach an itemization of all equipment used and rental rates. If equipment is a rental, attach copy of rental invoice. Rental equipment and contractor-owner equipment costs shall include all costs associated with the equipment, i.e., transportation, set-up gas and oil. Rental rates shall not exceed rates established by local rental companies and “MEANS DATA” rates.

5. Profit and overhead shall be considered full reimbursement for any additional expenses caused by the change order work. The Contractor shall agree to profit and overhead markup on work by his own forces as outlines in paragraph 10 below. These allowances for overhead and profit include among other costs; maintenance and/or operations of Contractor’s regular established office, branch office, and other facilities; resident and/or non-actively engaged supervision; time keepers; clerks; stenographers’ watchmen; cost of correspondence; increased item of warranty under the change.
6. The cost of the bond is not subject to overhead and profit.

7. A Change Order request shall not be considered unless submitted with all required and requested supporting documentation. All parties to the change shall use the Change Order Format.

8. For all work to be performed by Subcontractor/Subcontractors, the Contractor shall furnish the Subcontractors’ itemized proposal which shall contain original signatures by an authorized representative of the Subcontracting firm. If requested by the Owner or Architect, proposal from suppliers or other supporting data to substantiate the Contractor’s or subcontractor’s cost shall be furnished.

9. Change Order costs shall not exceed unit pricing as provided in the Contract Documents.

10. Unless otherwise specified, the allowable markup for combined overhead and profit, for work performed by the Contractor with his own forces will be based on the monetary value of the work in accordance with the following schedule.

<table>
<thead>
<tr>
<th>VALUE OF WORK</th>
<th>COMBINED OVERHEAD AND PROFIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 - $1,000</td>
<td>15%</td>
</tr>
<tr>
<td>$1,001 - $5,000</td>
<td>10%</td>
</tr>
<tr>
<td>$5,001 - $10,000</td>
<td>7%</td>
</tr>
<tr>
<td>$10,001 - $25,000</td>
<td>5%</td>
</tr>
<tr>
<td>$Over $25,000</td>
<td>Negotiated, but not more than 5%</td>
</tr>
</tbody>
</table>

11. For extra work performed by a Subcontractor with his own organization, the percentages for combined overhead and profit will be as outlined above. On the work partly or solely performed by a Subcontractor, the Contract will be allowed five percent (5%) of total costs of the Subcontractor’s labor, materials, overhead and profit only.

12. The Contractor shall submit all Change Order on the Owner’s Change Order Request Form, which is attached in the Contractor Documents.

§ 7.3.5 Deleted in its entirety

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor’s agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.6.1 Failure of the Contractor to advise the Architect of any disagreement with the Construction Change Directive within a reasonable period, and prior to the commencement of the change in the work involved, will constitute the Contractor’s agreement to the terms provided in the Construction Change Directive.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor’s agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order. Failure of the Contractor to advise the Architect of any disagreement with the construction Change Directive within a reasonable period, and prior to the commencement of the change in the work involved, will constitute the Contractor’s agreement to the terms provided in the Construction Change Directive.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Paragraph deleted in its entirety.
§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 MINOR CHANGES IN THE WORK
The Architect, with the concurrence of the Owner, will have authority to order minor changes in the Work not involving adjust in the contract Sum or extension of the contract Time and not inconsistent with the intent of the purposes of the building and the contract Documents. Such changes shall be affected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly.

ARTICLE 8 TIME
§ 8.1 Definitions
§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Notice to Proceed. If there is no Notice to Proceed it shall be such other date as may be established in the Owner-Contractor Agreement or elsewhere in the Contract Documents. The date shall not be postponed by the failure to act of the Contractor or of persons or entities for whom the Contractor is responsible.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8 or when the required certificate of use or occupancy has been received by the Owner, whichever is later.

§ 8.1.4 The term “day” as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion
§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.2.4 Should the progress of the Work be delayed by any fault, neglect, act, or omission of the Contractor or any person or firm employed by him or should it be necessary to complete the Work within the time permitted for the Contractor’s work, the Contractor shall, at his own expense, work such overtime as may be necessary to make up for all lost time and to avoid delay in completion of the Work. The Contractor shall compensate the Owner for and hold him harmless against any and all cost, expense, losses, liability, and damages which the Owner may sustain or incur by reason of such delay.

§ 8.3 Delays and Extensions of Time
§ 8.3.1 Requests for extension of completion time due to conditions over which the Contractor has no control or its subcontractors and suppliers have no control will be reviewed by the Owner after written application is made to the Owner and Architect for a time extension, with reasons stated clearly, and detailed proof give for all delays beyond the Contractor’s or its subcontractors and suppliers control. No time extension will be allowed except by written and specific approval of the Owner. Delays beyond the Contractor’s or its subcontractors and suppliers control may include: an act or neglect of the Owner’s own forces, Architect, or of an employee of either, or of a separate contractor employed by the Owner, or by changes orders in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor’s or its subcontractors and suppliers control or by other causes which the Owner and Architect determine may justify delay, then the Contract Time shall be extended by Change Order.

Extension of time shall be Contractor’s sole remedy for delays unless the same shall have been caused by acts constituting intentional interference by the Owner with Contractor’s performance of the
work where and to the extent such acts continue after contractor’s notice to Owner of such interference. Owner’s exercise of any of its rights under Article 7, Changes in the work, regardless of the extent or number of such changes, or Owner’s exercise of any of its remedies of suspension of the work, or requirement of correction or re-execution of any defective work, shall not under any circumstances, constitute intentional interference with Contractor’s performance of the work. No claim for extension of time shall be made or entertained on the basis of rejection of work in place, shop drawings, or samples or for nonconformance with the Contract Documents.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION
§ 9.1 Contract Sum
§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, adjustment of the applicable unit prices may be considered by the Owner or Contractor.

§ 9.2 Schedule of Values
Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor’s Applications for Payment. Any proposed changes to the schedule of values shall be submitted to the Architect and Owner and supported by such data to substantiate its accuracy as either may require, and unless objected to by either, shall be used as a basis for reviewing the Contractor’s subsequent Applications for Payment.

§ 9.3 Applications for Payment
§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor’s right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 Paragraph deleted in its entirety.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless previously approved by Owner, payments shall not be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. Similarly, unless previously approved by the Owner, payments shall not be made for materials and/or equipment stored off the site. Payment for materials and equipment stored off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner’s title to such materials and equipment or otherwise protect the Owner’s interest, and shall include applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the
Owner shall, to the best of the Contractor’s knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work. Nothing contained herein diminishes the responsibility of the contractor to replace stolen, defective, or vandalized work, materials or equipment.

§ 9.4 Certificates for Payment
§ 9.4.1 The Architect will, within seven days after receipt of the Contractor’s Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect’s reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect’s reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect’s evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect’s knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformity with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor’s right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.4.3 Retainage in the amount of five (5%) percent shall be withheld with each application for payment until Substantial Completion.

§ 9.4.4 In any event where the Architect, with cause does not certify payment or withholds certification to any extent, the Contractor shall nonetheless continue to fully perform the work.

§ 9.5 Decisions to Withhold Certification
§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect’s opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect’s opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of:
  .1 defective Work not remedied;
  .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
  .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
  .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
  .5 damage to the Owner or a Subcontractor;
  .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
  .7 repeated failure to carry out the Work in accordance with the Contract Documents.
  .8 mechanic’s lien notice or action filed, or reasonable evidence indicating probable filing of each notice of action.

§ 9.5.2 Paragraph deleted in its entirety.
§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments
§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect. Progress payments shall not be due until the following conditions have been achieved: (A) the Contractor has submitted a sworn Application for Payment in an Owner’s approved format showing all money paid out and costs incurred to the date of Application for Payment; (B) The Contractor has submitted unconditional lien waiver on a form acceptable to the Owner, establishing the total amount of payments to date and conditional lien waivers for the amount of payments to date and conditional lien waivers for the amount of the current request for all Subcontractors and Supplies.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor’s portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor’s payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney’s fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.
§ 9.7 Failure of Payment
If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the contractor’s Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contractor Documents the amount certified by the Architect, then the Contractor may, upon fifteen (15) additional days’ written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately, and the Contract Sum shall be increased by the amount of the Contractor’s reasonable costs of shut-down, delay, and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion
§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor’s list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect’s inspection discloses any item, whether or not included on the Contractor’s list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall complete all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.8.6 When the Architect and owner agree that the project has reached “Substantial Completion” as set forth in paragraph 8.1.3 is on schedule, and it appears that there are no complications or problems in completing the job, the retainage may be reduced to two and a half percent (2.5%) at the Owner’s discretion.

§ 9.9 Partial Occupancy or Use
§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment
§ 9.10.1 Upon receipt of the Contractor’s notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect
finds the Work acceptable under the Contract Documents and the Contract fully performed, and all warranties, O&M manuals, demonstrations, and training have been received or conducted, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect’s knowledge, information and belief, and on the basis of the Architect’s on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect’s final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor’s being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner’s property might be responsible or encumbered (less amounts withheld by the Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days’ prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment with AIA Form and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, release and waivers of liens, claims, security interest or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner and Release of Liens on the “Contractor’s Affidavit of Release of Liens and Payments of Debts and Claims” AIA Form (7) all records, drawings and specifications, addenda, change orders, and other modifications maintained at the site under the subparagraph 3.11.1 (verify) all warranties, instruction and maintenance manuals required. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such liens. If such lien remains unsatisfied after payments are made, the Contractor shall not become due until all close-out documents have been properly submitted to and certified by the Architect, and delivered by the Architect to the Owner.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from:
.1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
.2 failure of the Work to comply with the requirements of the Contract Documents;
.3 terms of special warranties required by the Contract Documents;
.4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.
.5 faulty or deceptive work appearing after substantial completion

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

§ 9.10.6 Final payment constituting the entire unpaid balance of the Contract Sum shall be paid by the Owner to the Contractor not later than sixty (60) days after the work has been completed and accepted by the Owner, and the Architect, in accordance with all other provisions of 9.10.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY
§ 10.1 Safety Precautions and Programs
The Contractor shall solely be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall submit the Contractor’s safety
program to the Owner. It is expressly understood and agreed that the Owner, the Architect, and his Project Representative are not in charge of the Work or in control thereof. Any provisions in the contract Documents in conflict with this Article shall be null and void.

§ 10.2 Safety of Persons and Property
§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to
.1 employees on the Work and other persons who may be affected thereby;
.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the Owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor’s obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor’s organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor’s superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect. This person, or approved alternate person, shall be on site at all times while personnel for whom they are responsible are on site. This person will be fully responsible for implementing and enforcing a program amongst his company’s employees, that ensures their safety and the safety of others affected by their work, and that is in full compliance with governing agencies including the Occupational Safety and Health Administration (OSHA).

§ 10.2.7 The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety or the safety of persons or property and the Contractor shall protect adjoining properties, streets, walkways, sidewalks, and paths so as to protect the safety of persons or property using such adjoining properties, walkways, sidewalks and paths.

§ 10.2.8 The Contractor shall maintain updated safety data sheets (SDS) for all materials used. A copy of the list must be kept on site by the Contractor in a readily accessible area. Under no circumstances will the storage of hazardous materials unnecessary for completion of the Work be allowed on site. It is the Contractor’s responsibility to promptly remove all stored hazardous materials from the site upon completion of the Work for which it is intended.
§ 10.2.9 The Contractor shall protect excavations and structures from damage by rain, water, ground water or water from any other source.

§ 10.2.10 The Contractor shall provide constant protection to maintain work, materials, apparatus and fixture free from injury and damage by rain, snow, wind, storms, frost, or heat and normal construction operations and shall protect work as necessary or at the end of each day's work.

§ 10.2.11 The Contractor shall remove work damaged due to failure to provide specified protection and replace the work at no additional cost to the Owner.

§ 10.2.12 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.1.1 In the event the Contractor encounters on the site material reasonably believed to be asbestos or polychlorinated biphenyl (PCB) which has not been rendered harmless, the Contractor shall immediately stop Work in the affected and report the condition to the Owner and Architect in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the Owner and Contractor if in fact the material is asbestos or polychlorinated biphenyl (PCB) and has not been rendered harmless. The Work in the affected area shall be resume in the absence of asbestos or polychlorinated biphenyl (PCB), or when has been rendered harmless, but written agreement or the Owner and contractor, or in accordance with final determination by the Architect.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity. Failure of contractor to stop work upon encountering asbestos of PCB per Subparagraph 10.3.1 shall relieve the Owner of responsibility for any losses by the Contractor attributable to these materials.

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User Notes:
§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner’s fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In any case of an emergency, the Contractor shall immediately respond in accordance with the Contractor’s safety plan and notify the Architect and Owner by the most expeditious means available, with a subsequent written notice explaining the situation and actions taken.

§ 10.4.1 Additional compensation or extension of time will not be considered or permitted for emergencies arising from delay, damage, or loss as a stipulated in 8.2.4 and 10.2.5 or other applicable provisions.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor’s Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect’s consultants shall be named as additional insured under the Contractor’s commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.1 The Contractor shall require all Subcontractors to maintain during the term of the contract commercial general liability insurance, business auto liability insurance, workers compensation insurance, employer liability insurance and umbrella excess liability insurance to the same extent required of the Contractor. The Contractor shall furnish Subcontractors’ certificates of insurance to the Owner immediately upon request.

§ 11.1.2 All insurance policies required hereunder shall be endorsed to provide that policy is not subject to cancellation, non-renewal or material reduction of coverage untily sixty (60) days prior written notice has been given to the Owner.

§ 11.1.3 All required insurance coverages must be underwritten by insurers allowed to do business in the State of Maryland and acceptable to the Owner. The insurers must also have a policy holders’ rating of “A-” or better, and financial size of “Class VII” or better in the latest evaluation by A.M. Best Company, unless Owner grants specific approval for an exception.

§ 11.1.2 Insurance Limits

§ 11.1.2.1 The Contractor shall purchase and maintain the following insurance coverages on an “occurrence” basis which shall be written for not less than the limits specified below or required by law, whichever is greater.

§ 11.1.2.1.1 Commercial general liability insurance or its equivalent for bodily injury, personal injury and property damage including loss of use, with minimum limits of:

$1,000,000 each occurrence;
$1,000,000 personal and advertising injury;
$2,000,000 general aggregate; and
$2,000,000 projects/completed operations aggregate

This insurance shall include coverage for all of the following:

i. General aggregate limit applying on a per project basis;
ii. Liability arising from premises and operations;
iii. Liability arising from actions of independent contractors;
iv. Liability arising from products and completed operations with such coverage to be maintained for two years after completion of Work;
v. Contractual liability including protection for contractor from bodily injury and property damage claims arising out of liability assumed under this Contract; and
vi. Liability arising from the explosion, collapse, or underground (XCU) hazards.

§ 11.1.2.1.2 Business auto liability insurance or its equivalent with a minimum limit of $1,000,000 per accident and including coverage for all of the following:

i. Liability arising out of ownership, maintenance or use of any automobile(s) (or hired and non-owned automobile(s) only if no owned automobile(s)); and
ii. Automobile(s) contractual liability.

§ 11.1.2.1.3 Workers compensation insurance or its equivalent with statutory benefits as required by any state or Federal law, including standard “other states” coverage; employer’s liability insurance or its equivalent with minimum limits of:

$100,000 each accident for bodily injury by accident;
$100,000 each employee for bodily injury by disease; and
$500,000 policy limit for bodily injury by disease.

§ 11.1.2.1.4 Umbrella excess liability or excess liability insurance or its equivalent with minimum limits of:

$5,000,000 per occurrence;
$5,000,000 aggregate for other than products/completed operations and auto liability; and
$5,000,000 products/completed operations aggregate

And including all of the following coverages on the applicable schedule of underlying insurance:

i. Commercial general liability
ii. Business auto liability; and
iii. Employers’ liability.

§ 11.1.2.1.5 The Board of Education of Washington County including its elected and appointed officials, officers, consultants, agents and employees and authorized volunteers of the Board of Education of Washington County shall be named as additional insureds on the contractor’s commercial general liability insurance and umbrella excess or excess liability insurance policies with respect to liability arising out of the Contractor’s projects, installation, and/or services provided under this Contract. Such coverage shall extend to cover the additional insured(s) for liability arising out of the following:

i. On-going operations; and
ii. Projects and completed operations.

The commercial general liability policy and the umbrella excess liability or excess liability policies, if required herein, must include additional insured language, which shall afford liability coverage for the exposures listed above in i. and ii.

§ 11.1.2.1.6 The certificate of insurance must be provided to the Purchasing Department of Washington County Public Schools prior to commencement of the Contract.
§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverage afforded under the policies will not be canceled or allowed to expire until at least 30 days prior written notice has been given to the Owner. If any of the foregoing insurance coverages are required to remain in force after final payment and are ready available, an additional certificate evidencing continuation of such coverage shall be submitted with the final Application for Payment as required by Section 9.10.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the contractor with reasonable promptness in accordance with the Contractor’s information and belief.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor’s Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner’s Liability Insurance
§ 11.2.1 The Owner will not provide Builder’s Risk protection as it does not apply.

§ 11.3 Waivers of Subrogation
§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, and Architect’s consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.4 or other property insurance applicable to the Work, except such rights as they have to proceed of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate shall require of the Architect, Architect’s consultant, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment the property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Property Insurance
§ 11.4.1 The Owner will effect and maintain “All Risk” insurance for physical loss or vandalism and malicious mischief perils subject to a deductible of $1,000 per occurrence upon all structures and appurtenances thereto on which the work of the contract is to be done to the full insurable value thereof, including materials in place or to be used as part of the permanent construction. Coverage shall protect the Owner, the Contractor and Subcontractor as interests may appear. The Owner does not maintain insurance of any kind on tools, equipment, temporary offices, sheds, shacks, and other property of the Contractor or his employees, no materials or supplies stored on site or away from the job site. It shall be the complete responsibility of the Contractor to provide for his own protection and that of his employees against any losses of such tools, equipment, and other property and materials.

§ 11.4.2 The Owner will not provide boiler and machinery insurances as it does not apply.

§ 11.4.3 Loss of Use, Business Interruption, and Delay in Completion Insurance
The Owner, at the Owner’s option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner’s property, or the inability to conduct normal operations, due to fire or other causes of loss. The

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User Notes:
Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner’s property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss
§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

§ 11.6. PERFORMANCE BOND AND PAYMENT BOND
§ 11.6.1 Unless waived by the Owner in writing, the contractor shall furnish a Performance Bond and Labor and Material Payment Bond covering the faithful performance of the Contract and the payment of all obligations arising thereunder and complying with the requirements of Maryland law. Both Bonds shall be in the amount of one hundred percent (100%) of the contract amount and shall name the Owner as Obligee. Firms issuing bonds must be licensed to write bonds in the State of Maryland. The Contractor shall pay premiums for required bonds. Obtaining of bonds by contractor shall be a condition precedent to effectuation of the Contract between the Owner and Contractor. If additional work is authorized the amounts of the bonds shall be increased to cover the value of the increased Contract sum. All bonds shall conform to the requirement of the Maryland Little Miller Act.

§ 11.6.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK
§ 12.1 Uncovering of Work
§ 12.1.1 If any portion of the Work is covered contrary to the request of the Architect or to the requirements specifically expressed in the Contract Documents, it must, if required in writing by either, the Architect, Owner, or any other governmental agency, be uncovered for their observation and be replaced at the Contractor’s expense without change in the Contract Time.

§ 12.1.2 If any portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor’s expense.

§ 12.2 Correction of Work
§ 12.2.1 Before Substantial Completion
The Contractor shall promptly correct Work rejected by the Architect or work that fails to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The contractor shall bear costs of correction such rejected Work, including
additional testing and inspections and compensation for the Architect’s, the Owner’s, or any governmental agency’s services and expenses made necessary thereby.

§ 12.2.1.1 Defective work shall include but not be limited to: Work which may be caused by deterioration or failure to perform due to premature wear (not occasioned by abuse), inherent defects in materials, workmanship of manufacturer, or fabrication, or improper execution of work.

§ 12.2.1.2 Cost of correcting such related work also includes all contingent damages arising therefrom, including damages to the work (whether installed by the contractor or another) and to other property of the Owner.

§ 12.2.1.3 Such warranties as provided herein do not deprive the Owner of the Owner’s right to prosecute any claim for breach of contract.

§ 12.2.1.4 Any defective or nonconforming work during this period, causing hazard to life, safety, property, or causing the Owner a financial loss, shall be corrected immediately without regard to normal working hours. The Owner will immediately endeavor to make telephone notice to the Contractor on the next working day.

§ 12.2.1.5 The Owner shall direct, if endeavors to contract the Contractor fail, certain telephone notification to Subcontractors in order to expedite emergency repairs. The Contractor shall not be relieved of this responsibility and shall supervise and direct correction of defects as required by the Contract Documents.

§ 12.2.1.6 The manufacturer of a product may be specifically mentioned as a party to a warranty. Then, in such cases, it shall be the contractor’s obligation to produce the required warranty of the manufacturer and submit it to the Architect for examination and approval. Inclusion of a manufacturer as a party to a warranty does not relieve the Contractor from the requirements of the Contract Documents.

§ 12.2.1.7 Warranties on operating systems, equipment, or components placed in operation prior to Substantial Completion or acceptance shall begin on the date of Substantial Completion.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor’s obligations under Section 3.5, if within two years after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract documents, any of the work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the two-year period for correction of Work, if the Owner fails to notify the correction by the contractor and give the Contractor an opportunity to make the correction, the Owner waives the right to require correction by the Contract and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.2 The two-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2. The two-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or other Contractors caused by the Contractor’s correction or removal of work which is not in accordance with the requirements of the Contract Documents, including attorneys’ fees and expenses.
§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the two year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor’s liability with respect to the Contractor’s obligations other than specifically to correct the Work.

§ 12.2.6 Inspection, failure to inspect, or approval or acceptance of any part of the work, or any payment on account thereof, shall not in any way limit the right to reject materials or equipment later found by the Architect, the Owner, or any Governmental Agency to be defective or not in accordance with requirements of the Contract Documents.

§ 12.3 Acceptance of Nonconforming Work
If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS
§ 13.1 Governing Law
The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction’s choice of law rules.

§ 13.2 Successors and Assigns
§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner’s rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies
§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No consent or waiver, expressed or implied, by either party to this agreement to or of any breach or default by the other in performance of any obligations hereunder shall be deemed or construed to be a consent or waiver to or any other breach or default by such party hereunder. Failure on the part of any party hereeto to complain of any act or failure to act of the other party or to declare the other party in default hereunder, irrespective of how long such failure continues, shall not constitute a waiver of the rights of such party hereunder. Inspection by, payment by, or tentative approval or acceptance by the Owner or the failure by Owner to perform any inspection hereunder, shall not constitute final acceptance of the work or any part thereof, and shall not release Contractor from any of its obligation hereunder.

§ 13.3.3 Contractor is subject to liquidated damages in the amount set forth on the bid form specification for delay of the date established in the Contract Documents for substantial completion, when such delay has been determined to be caused by the Contractor.

§ 13.4 Tests and Inspections
§ 13.4.1 Where Specifications or IBC Code required testing by an independent testing laboratory the Owner will retain and pay for the services of a testing laboratory under a separate contract. The Contractor shall be responsible for coordinating the scheduling of all tests with the testing laboratory. Reports, will be delivered to the Owner, Architect, and the Contractor simultaneously.
1. Tests, inspections and approvals of portions of the Work not listed in the Contract Documents be required by the laws, ordinances, rules, regulations or orders of public authorities or municipalities having jurisdiction shall be made at an appropriate time.

2. The Contractor shall make arrangements for such tests, inspections and approvals with the Owner's independent testing laboratory or with the appropriate public authority.

3. The Contractor shall give the Owner and Architect/Engineer timely notice of when and where tests and inspections are to be made so the Architect/Engineer may observe the procedures.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

(Paragraph Deleted)

§ 13.4.7 If required, subsequent to completion of construction, the Contractor shall submit to the Owner a signed certification indicating that to the best of his knowledge and belief, Work was performed in accordance with the approved Construction Documents.

§ 13.5 Interest.
No interest shall be paid by the Owner to Contractor under the Contract Documents.

§ 13.6.1 Contractor recognizes and agrees that Owner is a governmental Agency and that the statute of limitations is not applicable to the Owner.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

(Paragraphs Deleted)

14.1.1 Paragraph deleted in its entirety.

(Paragraph Deleted)

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.
§ 14.1.3 If one of the reasons described in Section 14.1.1 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed to date.

§ 14.1.4 Deleted in its entirety.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 If the Contractor is adjudged bankrupt or if he makes a general assignment for the benefit of his creditors, or if a receiver is appointed on account of insolvency, or if he fails to make prompt payment for materials, supplies, labor, or other items purchased or used in connection with the work or to Subcontractors, or if he fails to pursue the work in accordance with the contract Documents or schedules established, or fails to supply enough skilled supervisors, or workmen, or materials, tools, equipment, or supplies, or the proper quality (including failure occasioned by strike, picketing, boycott, or other cessation of the work), or if he interferes with or disrupts or threatens to interfere or disrupt the operations of the Owner, or any other Contractor or Subcontractor, which by reason of labor dispute, picketing, boycott, other cause, or

if he is otherwise guilty of a substantial violation of the provisions of the Contract Documents, the Owner may, without prejudice to any right or remedy and after giving the Contractor and his surety, if any, two (2) days' notice, or immediately in the event the default will in the reasonable judgment of the Owner, endanger the project if permitted to continue, terminate the employment of the Contractor and take possession of the site and materials in the Contractor's shop or in transit any may finish the work by whatever method he may deem expedient. In such case, the Contractor shall not be entitled to receive any further payment until the work is finished.

§ 14.2.2 When any of the above reasons exist, and the Owner confirms that sufficient cause exists to justify such action, the Owner may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, two (2) days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety;

1. Take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor
2. Accept assignment of subcontractors pursuant to Section 5.4; and
3. Finish the Work by whatever reasonable method the Owner may deem expedient.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract sum exceeds costs of finishing the work, including compensation for the Architect's services and expenses made necessary thereby, such excess shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall, upon application, be certified by the Architect in the manner provided in Paragraph 9.4, and this obligation for payment shall survive termination of the Contract.

§ 14.2.5 In addition to, and not in substitution of the remedies herein specified, the Owner may, with cause, upon two (2) days written notice to the Contractor, provide or arrange for the provision of such workmen and materials necessary to continue and complete the work contracted for hereunder for the account of the Contractor and at Contractor's cost and expense, and apply any and all funds which may become due to the Contractor thereon, all without terminating, rescinding or voiding this Agreement of releasing the Contractor from any liability hereunder.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time the Owner may determine.
§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent
1. that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
2. that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience
§ 14.4.1 The Owner may, at any time, terminate the Contract in whole or in part for the Owner’s convenience and without cause. Terminate by the Owner under this Paragraph shall be by a notice of termination delivered to the contractor specifying the extent of termination and the effective date.

§ 14.4.2 Upon receipt of a notice of termination for convenience, the Contractor shall immediately in accordance with instructions from the owner, proceed with performance of the following duties regardless of delay in determining or adjusting amounts due under this Paragraph;
1. cease operation as specified in the notice;
2. place no further orders and enter into no further Subcontracts for materials, labor services or facilities except as necessary to complete on-going portions of the Contract as directed by the Owner;
3. terminate all Subcontracts and orders to the extent they relate to the Work terminated;
4. proceed to complete the performance of Work not terminated; and
5. take actions that may be necessary or that the Owner may direct, for the protection and preservation of the terminated Work.

§ 14.4.3 Upon such termination, The Contractor shall recover as its sole remedy payment for Work performed in connection with the terminated portion of the work prior to the effective date of termination and for items properly and timely fabricated off the Project site, delivered and stored in accordance with the Owner’s Instructions. The Contractor hereby waives and forfeits all other claims for payment and damages including without limitation, anticipated profits.

§ 14.4.4 The Owner shall be credited (1) payments previously made to the Contractor for the terminated portions of the Work, (2) potential claims which the Owner has against the Contractor under the contract and (3) the value of the materials, supplies, equipment or other items that are to be disposed of by the Contractor that are part of the Contract Sum. The Owner may at its option also require that the Contractor assign the balance of the Contract to another Contractor of the Owner’s choosing. If the Contractor fails or refuses to execute any documents necessary to effectuate such assignment, the Owner may execute such documents on behalf of the Contractor.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims
§ 15.1.1 Definition
A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term “Claim” also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 15.1.2 Time Limits on Claims
Except as indicated in

(Paragraph Deleted)

§15.1.6 claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Claims must be initiated by written notice to the Architect and the other party.
§ 15.1.3 Notice of Claims
§ 15.1.3.1 Written notice shall be on Contractor's stationary; meeting minutes and facsimile transmission will not be considered written notice.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance
§ 15.1.4.1 Pending final resolution of a Claim, unless otherwise agreed in writing the Contractor shall proceed diligently with performance of the Work and the Owner shall continue to make payments in accordance with the Contract Documents except the Owner may withhold payment to an extent reasonably necessary to secure or compensate for a claim.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost
If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time
§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.6.3 It has been determined that the following table will be used to determine allowable non-compensable time extensions to the contract for "unusually severe weather" at the construction site based on a five (5) day work week.

<table>
<thead>
<tr>
<th>MONTH</th>
<th># of work days (*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>7</td>
</tr>
<tr>
<td>February</td>
<td>7</td>
</tr>
<tr>
<td>March</td>
<td>5</td>
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<tr>
<td>April</td>
<td>4</td>
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<tr>
<td>May</td>
<td>3</td>
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<tr>
<td>June</td>
<td>3</td>
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<tr>
<td>July</td>
<td>3</td>
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<tr>
<td>August</td>
<td>3</td>
</tr>
<tr>
<td>September</td>
<td>3</td>
</tr>
<tr>
<td>October</td>
<td>4</td>
</tr>
<tr>
<td>November</td>
<td>4</td>
</tr>
<tr>
<td>December</td>
<td>4</td>
</tr>
</tbody>
</table>

(* # of work days that may be expected to occur under normal weather conditions)

Actual adverse weather days must prevent work on critical activities for 50 percent or more of the contractor's scheduled work day. The number of actual adverse weather delays days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of
actual adverse weather delays exceed the number of days anticipated as listed above, the contractor shall be entitled to additional Contract time.

§ 15.1.7 Waiver of Claims for Consequential Damages
The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes:

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party’s termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision
§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to resolution of the claim in accordance with Article 6 of AIA Document A101-2017. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand resolution of the claim in accordance with Article 6 of AIA Document A101-2017 without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker’s sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to consider payment for such services but the Owner while not obligated to pay such expenses, will not unreasonably withhold such payment.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties to the extent that both parties agree, but subject to binding dispute resolution as defined per Article 6 of A101-2017 if the dispute remains unresolved as defined.
§ 15.2.6 Deleted in its entirety.

§ 15.2.6.1 Deleted in its entirety.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor’s default, the Owner may, but is not obligated to, notify the surety and request the surety’s assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic’s lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 16.1 POLICIES OF EMPLOYMENT

(Paragraph Deleted)

§ 16.1.1 The Contractor shall maintain the policies of employment as follows: The Contractor and all Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin or age. The contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, color, sex, national origin or age. Such action shall include but not limited to the following: Employment upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training including apprenticeship.

§ 16.1.2 The Contractor shall post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

§ 16.1.3 The Contractor and all subcontractors shall in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex, national origin, or age.

§ 16.1.4. Minority Business Enterprise (MBE) Requirements are part of the Conditions of the Contract.

§ 16.1.5 The Maryland General Assembly has enacted a law that prohibits a person who enters into a contract with the Board of Education of Washington County from knowingly employing an individual to work at a school if the individual is a registered sex offender. It is your duty as a person who has or, who may have, a contract with the Board of Education of Washington County to confirm whether an individual you plan to assign to work at a Washington County School(s) is a registered sex offender. A person who violates this law is guilty of a misdemeanor and or conviction is subject to imprisonment not exceeding five (5) years or a fine not exceeding $5,000.00 or both.

In the event you assign an individual to work at a Washington County School and a claim or lawsuit is asserted against the Board of Education of Washington County or any of its employees or agents as a result of such act or omission, you must indemnify and hold harmless the Board of Education of Washington County and its employees and agents from any and all losses, expenses, litigation expenses, attorney’s fees, court costs, settlements, judgments or the like.

(Paragraph Deleted)

§ 16.1.6 Protection of Resident Workers Clause
The contractor shall comply with all federal, State and local laws, regulations and ordinances applicable to its activities and obligation under this contract. The Immigration & Nationality Act (INA) includes provisions addressing employment eligibility, employment verification, and nondiscrimination. Under the INA,
employers may hire only persons who may legally work in the United States (i.e., citizens and nationals of the U.S.) and aliens authorized to work in the U.S. The employer must verify the identity and employment eligibility of anyone to be hired. The contractor shall establish appropriate procedures and controls so no services or products under the contract documents will be performed or manufactured by any worker who is not legally eligible to perform such services or employment. For more information, visit the U.S. Citizenship and Immigration Services website: www.uscis.gov.
Proposal Request Form

Project Name: 

Date: 

Proposal Request #: 

Prime Contractor: 

Subcontractor: 

Sub-Subcontractor: 

Proposal Scope (Include a brief description of the work) 

---

<table>
<thead>
<tr>
<th>A. Labor, Materials, Equipment</th>
<th>$</th>
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</thead>
<tbody>
<tr>
<td>A.1 Direct Payroll - wages less burden (no fringes, insurances, taxes, etc)</td>
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<tr>
<td>A.2 Material Cost</td>
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<tr>
<td>A.3 Equipment Rental</td>
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</tr>
<tr>
<td>A.4 Direct Equipment Cost</td>
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Subtotal A - Labor, Materials, Equipment: $ - A

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<thead>
<tr>
<th>B. Overhead &amp; Profit</th>
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</thead>
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<tr>
<td>Allowable Overhead &amp; Profit = (Subtotal A) x (% listed below)</td>
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<td></td>
</tr>
<tr>
<td>15% $0.00 - $1,000</td>
<td>$</td>
<td>-</td>
</tr>
<tr>
<td>10% $1,001 - $5,000</td>
<td>$</td>
<td>-</td>
</tr>
<tr>
<td>7% $5,001 - $10,000</td>
<td>$</td>
<td>-</td>
</tr>
<tr>
<td>5% $10,001 - $25,000</td>
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</tr>
<tr>
<td>over $25,000 negotiable not to exceed 5%</td>
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Subtotal B - Overhead & Profit: $ - B

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<thead>
<tr>
<th>C. Sales Tax (6% x (A.2 + A.3))</th>
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<table>
<thead>
<tr>
<th>D. Labor Burden</th>
<th>% x A.1</th>
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<th>-</th>
</tr>
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<tbody>
<tr>
<td>Must provide back-up to substantiate Labor Burden Rate</td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>E. Subcontractor Cost</th>
<th>$</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subcontractor Cost (Provide detailed breakdown on separate form)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Allowable Prime Contractor Mark-Up (5% of Subcontractor Cost)</td>
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<td>-</td>
</tr>
</tbody>
</table>

Subtotal E - Subcontractor Cost: $ - E

<table>
<thead>
<tr>
<th>F. Subtotal (A+B+C+D+E)</th>
<th>$</th>
<th>-</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>G. Bond (1% of F)</th>
<th>$</th>
<th>-</th>
</tr>
</thead>
</table>

| H. TOTAL COST = F + G | $ | - |

---
DIVISION 1

GENERAL REQUIREMENTS
SECTION 01 10 00 – SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 0 and Division 1 Specification Sections, apply to the Work of this Section.

1.2 SUMMARY
This Section includes the following:

1. Project Information
2. Schedule
3. Contractor Responsibilities
5. Cleaning and Protecting
6. Use of Premises and Temporary Facilities
7. Owner's Occupancy Requirements
8. Work Restrictions
9. Specification Formats and Conventions
10. Work Scope

1.3 PROJECT INFORMATION

A. Auditorium and Stage Renovations at Boonsboro High School

B. Location: 10 Campus Avenue
   Boonsboro, Maryland 21713

C. Owner: Board of Education of Washington County
   10435 Downsville Pike
   Hagerstown, Maryland 21740

D. Architect: Bushey Feight Morin Architects
   473 North Potomac Street
   Hagerstown, MD 21740

E. Bid Number: 2020-18
F. Project Description:

Selective demolition and interior renovations to create a renovated auditorium, stage, new front lobby, security vestibule and other interior renovations as described in the Contract Documents.

Asbestos Containing Materials (ACMs) could be encountered in the Work as identified in the Contract Documents. The Contractor is responsible for the proper abatement of ACMs, and independent third party air monitoring/Industrial Hygienist services as required, within the project area, as part of the Contract Work.

1.4 SCHEDULE

A. The Contract Award is anticipated to occur in **January 2020** and the “Notice of Award” letter will be issued immediately afterward.

B. The Contractor shall provide all required submittals to the Owner and Architect within thirty (30) days after the “Notice of Award” is issued, or sooner if necessary to avoid delay of work.

C. The field work is to occur when school is in session during the 2020-2021 school year. **The Field Start Date shall be March 2, 2020.**

D. **The Total Project Substantial Completion Date is August 14, 2020.** The Contractor is responsible for obtaining the Certificate of Occupancy from the Washington County Division of Construction on or before the Substantial Completion Date. The Final Project Completion Date is September 18, 2020.

E. The Contractor shall order materials as soon as submittals are approved by the Architect so that the materials are in possession upon commencement of field work. If any materials can be delivered prior to the last day of school, the Contractor is responsible for proper **offsite** storage.

F. The Contractor shall prepare and submit for the Owner’s and Architect’s approval a detailed Work Plan and Construction Schedule for the Work within ten (10) days after the “Notice of Award” is issued.

G. Contractor shall maintain, at all times, sufficient manpower levels to meet scheduling requirements and avoid delay to completion of work.

H. Liquidated Damages:

**Total Project:** Should the Work not be performed on or before the times stated, there will be deducted from the Contract Balance the sum of five hundred dollars ($500.00) per consecutive calendar days, as Liquidated Damages, but not as a penalty, for each day’s delay after expiration of such period, and until final completion of the Work and its acceptance by the Owner. Plus the contractor will be held responsible for additional extended general conditions, consumables, and direct labor costs to the Third Party Inspectors and the Architect for work and re-inspections required until the “Contract Work” is determined to be acceptable by the Owner.
Completion of Punchlist Items: Should the Contractor fail to correct punchlist items within the 15 day period (beginning the date of the receipt of the list) there will be deducted from the Contract Balance the sum of fifty dollars ($50.00) per item per consecutive calendar days, as Liquidated Damages, but not as a penalty, for each day’s delay after expiration of such period, and until final completion of the Work and its acceptance by the Owner.

1.5 CONTRACTOR RESPONSIBILITIES includes but is not limited to the following:

   A. Shop Drawings, Product Data, and Samples.

   B. Receive and unload products at site. Inspect for completeness and damage. Repair or replace items damaged after receipt.

   C. Handle, store, install and finish products.

   D. Pay legally required sales, consumer and use taxes.

   E. When it is necessary to modify or interrupt existing utility service, the Contractor shall notify the Owner a minimum of 14 days prior to the planned work. Obtain the Owner’s written approval.

   F. All Labor, Materials, Equipment, and Other facilities and services necessary for proper execution and completion of work. This includes but is not limited to multiple mobilizations and any escalation in material and fuel costs throughout the duration of the project.

   G. Perform all work to comply with the rules and the regulations of the governing bodies and state and local laws.

   H. The Owner shall obtain and pay for the Building Permit. The Contractor shall obtain and pay for all other permits and inspections required by law for the execution of this Work. The Contractor is responsible for coordinating scheduling all inspections with the Washington County Division of Construction and the State Fire Marshal as necessary. Provide all permits and inspection certificates to the Owner for their records.

   J. All utility usage charges for permanent services during construction shall be by the Owner. All temporary services and usage charges required by the Contractor to perform their Work shall be arranged for and paid for by the Contractor.

   K. Field Engineering:

       1. Contractor shall be solely responsible for properly laying out the work and for all lines and measurements for all of the work executed under the Contract Documents.

       2. All dimensions and grades shown on Drawings are believed to be correct, but the Contractor shall verify them at the site and notify the Owner and Architect in writing of any discrepancies found before proceeding with the work. In the absence of such notifications, extra work caused by discrepancies shall not entitle Contractor’s to additional compensation.
3. Working from lines and levels established by property survey, and as shown in relation to the work. Calculate and measure required dimensions as shown (within recognized tolerances if not otherwise indicated); do not scale drawings to determine dimensions. Contractor shall be solely responsible for the proper location and level of all the work and for the maintenance of the reference lines and bench marks.

L. Work by Others:

1. The Owner will maintain use of its school building located on the premises.

2. The Owner will maintain the right to have additional trade contractors (at its discretion) working on site during the course of the project.

1.6 GENERAL INSTALLATION PROVISIONS

A. Installer’s Inspection of Conditions: Each Installer is required to inspect substrate to receive work, and conditions under which work will be performed, and to report, in writing to the Owner and the Architect, unsatisfactory conditions.

B. Manufacturer’s Instructions: Where installations include manufactured products, comply with manufacturer’s applicable instructions and recommendations for installation when they are more explicit or more stringent than the requirements indicated in Contract Documents.

C. Inspect each item of material or equipment immediately prior to installation, and reject damaged and defective items.

D. Provide attachment and connection devices and methods for securing work properly as it is installed; true to line and level, and within recognized industry tolerances if not otherwise indicated. Allow for expansions and movements. Provide uniform joint widths in exposed work, organized for best possible visual effect. Refer questionable visual-effect choices to the Architect for final decision.

E. Recheck measurements and dimensions of the work, as an integral step of starting each installation.

F. Install work during conditions of temperature, humidity, exposure, forecasted weather, and status of project completion which will ensure best possible results for each unit of work, in coordination with entire work.

G. Concealed Work: Coordinate enclosure of work, with the Owner and the Architect and with required inspections and tests, so as to minimize necessity of uncovering work for that purpose. Record exact locations of utility work on Record Drawings.

H. Mounting Heights: Where mounting heights are not indicated, mount individual units of work at industry-recognized standard mounting heights, or at heights specified by applicable codes, for
applications indicated. Refer questionable mounting height choices to the Owner and Architect for final decision.

I. Enclose and conceal from view wiring, conduit, ducts, heat piping, sprinkler piping, water piping and other utility lines in habitable rooms and spaces, unless otherwise shown or specified.

J. Where not otherwise shown, match adjacent masonry, gypsum board or other finish construction to form the enclosing chase or furring.

K. Locate sprinkler heads, ceiling diffusers, lighting fixtures, grilles, speakers and other similar items in ceiling lay-in panels centered in both directions or to fill a full ceiling grid module.

L. Coordination: Do not fabricate or install ductwork, electric conduit, pull boxes, piping and other mechanical items above suspended ceilings until the coordination process has verified that there will be no interference and that the space for construction materials, equipment, fixtures and finishes specified by the design requirements can be maintained. Prior to fabrication and installation, promptly report to the Owner and Architect apparent interference or difficulties anticipated.

1.7 CLEANING AND PROTECTION:

A. During handling and installation of work at project site, clean and protect work in progress and adjoining work on a basis of perpetual maintenance. Apply suitable protective covering on newly installed work where reasonably required to ensure work is free from damage or deterioration at time of substantial completion; otherwise, clean and perform maintenance on newly installed work as frequently as necessary through remainder of construction period.

B. Limiting Exposure of Work: To extent possible through reasonable control and protection methods, supervise performance of work in a manner and by means which will ensure that none of the work, whether completed or in progress, will be subjected to harmful, dangerous, damaging, or otherwise deleterious exposures during construction period. Such exposures include where applicable (but not by way of limitation) static loading, dynamic loading, internal pressures, external pressures, high or low temperatures, thermal shock, high or low humidity, air contamination or pollution, water, ice, solvents, chemicals, light, radiation, puncture, abrasion, heavy traffic, soiling, bacteria, insect infestation, combustion, electrical current, high speed operation, improper lubrication, unusual wear, misuse, incompatible interface, destructive testing, misalignment, excessive weathering, unprotected storage, improper shipping/handling, theft and vandalism.

C. Construct work in accordance with project schedule; coordinate the schedule and operations with the Owner.

1.8 USE OF PREMISES AND TEMPORARY FACILITIES

General: During the construction period, the Contractor shall have limited use of the premises. Use of any areas other than those in which work is done is prohibited.
A. Use of Site: Confine construction operations to areas within the limits indicated on the Contract Documents. Do not disturb the building and property beyond areas in which the Work is indicated.

B. Owner Occupancy: Allow for Owner occupancy of facility and use by the Public during the entire construction period for the portions of the facility not being disturbed by construction. Maintain code compliant egress in Owner occupied spaces.

C. Contractor has access to schools’ water supply for use during construction.

D. Temporary toilet facilities are not required; a school restroom will be designated for contractor use at the facility.

E. Contractor use of the school's phone or internet services is not permitted.

F. Parking: During construction operations, contractor parking is limited to the discretion of the Owner.

G. Contractor field office trailer(s) will not be permitted on school property for this project.

H. Driveways and Entrances: Keep driveways, loading areas, and entrances serving the premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials without obtaining prior written authorization from the Owner.

1. Schedule and coordinate deliveries to minimize use of driveways and entrances.

2. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

3. Lay down and staging areas will be established jointly by the Contractor and the Owner within the Construction Limits of Disturbance.

1.9 OWNER’S OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: Owner will occupy the building and property for the duration of the project. Cooperate with the Owner during the construction operations to minimize conflicts and facilitate Owner and Public usage. Perform the Work so as not to interfere with the Public and the Owner’s day-to-day operations. Maintain existing entrances and exits. Provide not less than 14 days’ notice to the Owner of activities that will affect the Public and the Owner's operations.

B. Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.

1. The Architect will prepare a Punchlist for each specific portion or area(s) of the Work to be occupied before Owner occupancy.
2. The Contractor is to obtain approval from Authorities Having Jurisdiction before Owner occupancy of completed spaces.

3. Prior to Owner occupancy, all work shall be fully operational, and required tests and inspections shall be successfully completed. Upon completion of the project, the Owner and Architect will issue a Certificate of Substantial Completion indicating acceptance.

4. Upon Project Substantial Completion, Owner will assume responsibility for maintenance and custodial service for occupied portions of work.

1.10 WORK RESTRICTIONS

A. For this project, the Contractor will have access to the school Monday-Friday from 6am-4pm. If the Contractor chooses to work Saturdays, Sundays, or when schools are closed, the Contractor must request written approval from WCPS at least four (4) days in advance of needing access to the school and must pay the $25.00 per hour rate at a minimum of four (4) hours for custodial coverage on these days. Work requiring inspections cannot be completed on the weekend.

B. Contractor shall prioritize the safety of students and staff while working in the occupied building and shall take all necessary precautions to protect the wellbeing of all occupants at all times.

C. The Contractor is responsible for conducting construction activities so as to minimize impact to spaces outside of the project area and so as to avoid any disruption to school activities.

D. The Contractor is responsible for controlling the containment of dust and debris for the full duration of the project.

E. All work to comply with the Noise Restrictions of the local governing authority.

F. All workers on site are to wear hardhats, clean clothes (shirts & pants – no shorts), protective eyeglasses and protective footwear, and visible identification badges displayed at all times. The Contractor is responsible for providing identification badges for all workers.

G. Do not interrupt existing utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

   1. Notify the Owner not less than 14 days in advance of proposed utility interruptions.

   2. Do not proceed with utility interruptions without receiving the Owner’s written permission.

1.11 SPECIFICATION FORMATS AND CONVENTIONS

A. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not
used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

C. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

1. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by each Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by each Contractor or by others when so noted.

2. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

D. Definitions

1. The terms “Architect”, “Engineer”, “Architect/Engineer” and “A/E” are used interchangeably throughout the specifications.

   The terms “Owner”, “Washington County Public Schools” and “WCPS” and the “Board of Education” and the “BOE” are used interchangeably throughout the specifications.

1.12 WORK SCOPE

The scope of work includes but is not limited to providing all labor, equipment, materials, and incidentals to complete all Work in accordance with the specifications, drawings and applicable codes. All Work is to be performed as shown on the Contract Drawings and Specifications in the Project Manual.

In addition to the above, the scope includes but is not limited to the Division 0 Procurement and Contract Requirements, and Division 1 General Requirements of the Project Manual.

THE SCOPE OF WORK IS TO INCLUDE, but is not limited to, the following items:

1. Contractor shall provide all required submittals to the Architect within thirty (30) days after issuance of “Notice of Award”/“Notice to Proceed”, or sooner if necessary to avoid delay of work.
2. Contractor shall be required to conduct his activities in a safe manner and shall be responsible for observing the safety regulations of MOSH, OSHA, and local life safety agencies. Contractor to provide all OSHA specified protection required, including fall protection.

3. Contractor shall maintain at all times sufficient manpower levels to meet scheduling requirements and avoid delay to completion of work.

4. Contractor shall provide as-built drawings and warranty of all work under this Contract. Provide copies of Operation and Maintenance Manuals in the format and quantity indicated in the documents. Provide instruction of Owner’s personnel on maintenance of equipment and material installed by this Contract.

5. Contractor must be on site to receive and unload construction material deliveries. WCPS staff is not responsible for receiving any deliveries for this construction project. Contractor is responsible for own lifting and hoisting.

6. Contractor shall protect all existing finishes when receiving deliveries and removing trash through areas of the facility outside the limits of disturbance. Contractor shall protect all finished areas of work adjacent to area of new work as construction progresses within the project limits.

7. Provide dumpsters or trucking required to clean and remove daily from site all excess material and debris connected with this work. Should the Contractor’s cleanup be unsatisfactory, the Owner shall perform the work at the Contractor’s expense. If dumpsters are utilized, the Contractor shall coordinate with the Owner to identify a mutually agreeable location prior to commencement of work. The Contractor is responsible for preventing damage to property, such as by setting the dumpsters on plywood in paved areas, and is responsible for repairing any damage occurring as result of the dumpsters.

8. The Contractor is responsible for controlling the containment of dust and debris for the full duration of the project. The Contractor shall provide 100 linear feet of 9’-4” high wood framed dust partitions to control dust between the construction zone and the occupied areas of the school.

9. The Owner will clear furniture surfaces and remove loose furniture in the project area prior to demolition. The Contractor shall protect bulk furniture and built-ins within and adjacent to the project area by covering them with plastic sheets throughout demolition and construction. Once renovations are complete, the Contractor is responsible for removing the plastic sheets and thoroughly vacuuming and cleaning the entire project area.

10. Contractor shall provide final cleaning of all new and existing surfaces within the project limits. Include cleaning all glazing. Including wet mop of floor tile only; the Owner will wax the floors. Prior to final cleaning, Contractor shall remove all miscellaneous labels, stickers, and shipping protection from all hardware and other finish products. Do NOT remove any fire rating labels.

11. Prior to the installation of new flooring, the Contractor is responsible for properly preparing the existing concrete floor substrate and for applying leveling and patching compounds for a smooth and level floor finish. Contractor is responsible for grinding down existing concrete as necessary.
for a smooth and level floor finish. Contractor shall provide new flooring to match, and properly transition to, existing adjacent flooring.

12. Contractor shall patch and refinish existing walls and ceilings that are adjacent to, and affected by, work performed under this contract as necessary for a finished product in exposed areas. Contractor shall patch existing masonry walls and drywall partitions as necessary to maintain wall rating at the top of walls and at through-wall penetrations above the ceiling.

13. Contractor shall provide all priming, block filling, and finish painting of all drywall, CMU, door frames, and other interior surfaces as required and as indicated in the Contract Documents. Contractor is responsible for all required surface preparation prior to application of finishes, including, but not limited to scraping, sanding, puttying, etc. Provide interior caulking between surfaces of dissimilar materials such as at hollow metal frames in drywall or block walls, CMU block abutting drywall construction, interior joints of painted wood surfaces, etc.

14. Contractor shall turn over all keys, tagged and marked in an acceptable manner to the Owner.

15. Project Administration:
   a. The Contractor is responsible for project budget, project construction schedule, project coordination, project administration and overall site management, including safety and security.
   b. The Contractor shall be responsible for coordination of demolition and new construction work between various trades.
   c. Contractor shall comply with the directives of the Owner, and respond to the comments from the Architect for this Project.

16. Contractor is responsible for testing costs resulting from negligence, poor workmanship, or failure of work to meet the requirement of the documents. Any work determined to have been performed in a negligent manner by the Contractor shall be corrected by the Contractor at no additional cost to the Owner.

17. Contractor is responsible for taking all precautions necessary to ensure all existing power and data lines and connections remain intact throughout construction. The Contractor is responsible for verifying that all power and data lines and connections and devices are in operating order upon completion of the project and if not, the Contractor is responsible for repair and/or replacement.

END OF SECTION
PART 1  GENERAL

1.1  SECTION INCLUDES

A. Submission procedures.

B. Documentation of changes to Contract Sum/Price and Contract Time.

1.2  DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
   1. The cost or credit for each alternate is the net addition to the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.
   2. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate. Include costs of related coordination, modification, or adjustment.

1.3  RELATED SECTIONS

A. Documents Owner/Contractor Agreement Form: Incorporating monetary value of accepted Alternates.

B. Section 00 20 00 - Standard Form of Proposal: Cost of Alternates.

C. Section 00 21 13 - Instructions to Bidders.

D. Section 01 10 00 - Summary.

E. Section 01 60 00 - Product Requirements: Product options and substitutions.

1.4  REQUIREMENTS

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner’s option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

C. Coordinate and verify that Alternates comply with all selected LEED credit and prerequisite criteria. Verify material and indoor environmental credit criteria complies for all products and systems installed as Alternates.

D. The prices for Alternates do not form a portion of the Contractor’s Base Bid, but if accepted, will be incorporated to the Base Bid to determine the total Contract Sum. The Owner reserves the right to accept or reject any or all Alternates in any order or
combination. Acceptance or rejection of any Alternates does not relieve the Contractor of timely completion of the Work within the time periods indicated. The Contract Documents shall be considered appropriately modified by either the acceptance or rejection of Alternates.

F. Alternate Bids shall include all costs associated with the described Alternate or reasonably inferable therefrom. Claims for increases to the Contract Sum resulting from changes caused by the acceptance or rejection of any Alternate Bid will not be allowed.

1.5 SELECTION AND AWARD OF ALTERNATIVES

A. Indicate variation of Bid Price for Alternates described below and list in Bid Form Document or any supplement to it, which requests a “difference” in Bid Price by adding to the base bid price.

B. Bid will be evaluated on base bid and accepted alternates determined by the Owner.

1.6 SCHEDULE OF ALTERNATES

A. ALTERNATE No. 1: 101-Security Vestibule
   1. In accordance with the Drawings and Specifications, submit the cost to construct 100-Vestibule and 101-Security Vestibule. Shall include cost to demolish and dispose of existing metal canopy assembly and concrete walk below canopy this area.

B. ALTERNATE No. 2: Terrazzo Tile in 105-Gathering/Display
   1. In accordance with the drawings and specifications, submit the cost to provide and install new terrazzo tile in 105-Gathering/Display as specified in Section 09 66 23 in lieu of new quartz tile as specified in Section 09 65 00.

C. ALTERNATE No. 3: 116,117-Restroom, 118A-Custodial, and Interior Ramp in 115-Corridor
   1. In accordance with the Drawings and Specifications, submit the cost for the following:
      a. 116-Girls Restroom renovation
      b. 117-Boys Restroom renovation
      c. 113A-Choral Corridor including new 113A door and frame assembly
      d. New interior ADA ramp in 115-Corridor including demo of existing interior stair this area.
      e. Interior renovations in 118-Instrumental Lab and 118A-Custodial as required to install new doors and frames.

D. ALTERNATE No. 4: Not Used

E. ALTERNATE No. 5: 119-Covered Walkway
   1. In accordance with the Drawings and Specifications, submit the cost to construct 119-Covered Walkway. Shall include cost to provide and install ornamental fence and gate assembly below as specified in Section 02 83 20.

F. ALTERNATE No. 6: 114-Storage Addition
   1. In accordance with the Drawings and Specifications, submit the cost to construct 114-Storage Addition.
G. ALTERNATE No. 7: Linear Ceiling and Lighting in 103-Lobby, 105-Gathering/Display, and 106-Lobby

1. In accordance with the Drawings and Specifications, submit the cost to provide and install new linear ceiling assembly and linear lighting in 103, 105, and 106 in lieu of new 2x2 acoustical ceiling tile, grid, and lighting. Linear ceiling shall be as specified in Section 09 51 10, Article 2.4, Paragraph C - Linear wood ceiling (C3). Base bid shall be as specified in Section 09 51 10, Article 2.4, Paragraph A – Acoustical Panels (C1).


1. In accordance with the drawings and specifications, submit the cost to provide and install new TPO single ply roofing system over 100, 101, 105, 114, and 119 in lieu of hybrid composite built-up asphalt roofing system. TPO shall be as specified in Section 07 54 10. Base bid shall be as specified in Section 07 52 20.

2. Alternate No. 8A: TPO Over 100-Vestibule
3. Alternate No. 8B: TPO Over 101-Security Vestibule
4. Alternate No. 8C: TPO Over 105-Gathering Display
5. Alternate No. 8D: TPO Over 114-Storage
6. Alternate No. 8E: TPO Over 119-Covered Walk

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION
PART 1  GENERAL

1.1  SECTION INCLUDES

A. Schedule of Values.
B. Unit Costs.
C. Cash Allowances.

1.2  SCHEDULE OF VALUES

A. Submit printed schedule AIA Form G702 - Application and Certifications for Payment with AIA Form G703 - Continuation Sheet.
B. Submit electronic copy of the Schedule of Values within fifteen (15) days after date established in Notice to Proceed for review by Owner and Architect. Review to incorporate comments from Owner/Architect to gain written approval.
C. Format: Utilize Table of Contents of this Project Manual. Identify each line item with number and title of major Specification Sections. Identify bonds as a separate cost. Separate labor from materials and equipment.
D. Revise schedule to list approved Change Orders, with each Application for Payment.

1.3  UNIT PRICES

A. Unit Prices shall be used for both “Extra Work” and “Credit” and shall be identified on the Bid Proposal Form in Section 00 22 00.
B. Authority: Measurement methods are delineated in individual specification sections.
C. Measurement methods delineated in individual specification sections complement criteria of this section. In event of conflict, requirements of individual specification section govern.
D. Take measurements and compute quantities. Owner’s field representative will verify measurements and quantities.
E. Unit Quantities: Actual quantities supplied or placed in the Work shall determine payment.
1. When actual work required more or fewer quantities that those indicated, provide required quantities at unit prices contracted.
F. Payment Includes: Full compensation for required labor, products, tools, equipment, plant and facilities, transportation, services and incidentals; erection, application or installation of item of the Work; overhead and profit.
G. Final payment for Work governed by unit prices will be made on basis of actual measurements and quantities accepted by Architect/Engineer multiplied by unit sum/price for Work incorporated in or made necessary by the Work.
H. Measurement of Quantities:
1. Weigh Scales: Inspected, tested and certified by applicable State department.
   Weights and Measures department within past year.
2. Platform Scales: Of sufficient size and capacity to accommodate conveying vehicle.
3. Metering Devices: Inspected, tested and certified by applicable State department.
4. Measurement by Weight: Concrete reinforcing steel, rolled or formed steel or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.
5. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
6. Measurement by Area: Measured by square dimension using mean length and width or radius.
7. Linear Measurement: Measured by linear dimension, at item centerline or mean chord.
8. Stipulated Sum/Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as completed item or unit of the Work.
9. Costs shall be quoted utilizing prevailing wage.

I. Unit Price Schedule
1. Unit Price No. 1 – “Open” Excavation Earth (Machine)
   a. Description: Includes machine excavation of soils below grade of excavation as indicated and stockpiling as specified in Section 02 22 20 and as directed by the Owner.
   b. Unit of Measurement: Cu. Yd.

2. Unit Price No. 2 – “Open” Excavation Earth (Trench).
   a. Description: Includes machine excavation of soils in Trenches below grade of excavation as indicated and stockpiling as specified in Section 02 22 20 and 02 22 50, and as directed by the Owner.
   b. Unit of Measurement: Cu. Yd.

3. Unit Price No. 3 – “Open” Excavation Earth (Hand)
   a. Description: Includes hand excavation of soils below grade of excavation as indicated and stockpiled as specified in Section 02 22 20, and as directed by the Owner.
   b. Unit of Measurement: Cu. Yd.

4. Unit Price No. 4 – “Open” Removal of unsuitable soils.
   a. Description: Includes removal and legal offsite disposal of unsuitable excavated material from site below grade of excavation as indicated and as specified in Section 02 22 20.
   b. Unit of Measurement: Cu. Yd.

5. Unit Price No. 5 - Open Rock (Chemical)
   a. Description: Chemical removal, legal offsite disposal and replacement with structural fill material of any rock encountered in open excavation below grade of excavation as indicated and which cannot be removed by ripping, as shown on the drawings and as specified in Division 2 of Section 02 22 20.
   b. Unit of Measurement: Cu. Yd.
6. Unit Price No. 6 - Open Rock (Mechanical)
   a. Description: Mechanical removal, legal offsite disposal and replacement with structural fill material of any rock encountered in open excavation below grade of excavation as indicated and which cannot be removed by ripping, as shown on the drawings and as specified in Division 2 of Section 02 22 20.
   b. Unit of Measurement: Cu. Yd.

7. Unit Price No. 7 - Trench Rock (Chemical)
   a. Description: Chemical removal, legal offsite disposal and replacement with structural fill material of any rock encountered in trench excavation below grade of excavation as indicated and which cannot be removed by ripping, as shown on the drawings and as specified in Division 2 of Section 02 22 20.
   b. Unit of Measurement: Cu. Yd.

8. Unit Price No. 8 - Trench Rock (Mechanical)
   a. Description: Mechanical removal, legal offsite disposal and replacement with structural fill material of any rock encountered in trench excavation below grade of excavation as indicated and which cannot be removed by ripping, as shown on the drawings and as specified in Division 2 of Section 02 22 20.
   b. Unit of Measurement: Cu. Yd.

9. Unit Price No. 9 – “Trench” Unsuitable Soils
   a. Description: Includes removal and legal offsite disposal of unsuitable excavated material from trench as specified in Section 02 22 50 below the grade of excavation as indicated.
   b. Unit of Measurement: Cu. Yd.

10. Unit Price No. 10 - Stone Fill.
    a. Description: Includes crushed stone (granular fill), installed and compacted in place as specified in Section 02 22 30.
    b. Unit of Measurement: Cu. Yd.

11. Unit Price No. 11 - Controlled Compacted Fill (Structural fill)
    a. Description: Includes material and placement of controlled compacted fills as specified in Section 02 22 30.
    b. Unit of Measurement: Cu. Yd.

12. Unit Price No. 12 - Lean Concrete Fill.
    a. Description: Includes material and placement of 4000 psi lean concrete as specified in Section 02 22 30.
    b. Unit of Measurement: Cu. Yd.

13. Unit Price No. 13: Hot Mix Asphalt trench patch, 19.0 mm, 2-1/2 inch thick
    a. Description: Includes placement by hand or machine of HMA in trenches up to 6’ wide as specified in Section 02 51 00.
    b. Unit of Measurement: Square Yard

14. Unit Price No. 14: Hot Mix Asphalt trench patch, 9.5mm, 1-1/2 inch thick SY
    a. Description: Includes placement by hand or machine of HMA in trenches up to 6’ wide as specified in Section 02 51 00.
    b. Unit of Measurement: Square Yard
15. Unit Price No. 15: Hot Mix Asphalt Surface, 9.5 mm, ton  
a. Description: Includes placement of HMA in 6’ and wider strips as specified 02 51 00.  
b. Unit of Measurement: Ton.  
16. Unit Price No. 16: Hot Mix Asphalt Base 19.0mm, ton  
a. Description: Includes placement of HMA in 6’ and wider strips as specified in Section 02 51 00.  
b. Unit of Measurement: Ton.  
17. Unit Price No. 17: No. 57 stone base 6” price per SY.  
a. Description: Includes placement of stone in 6 inch lifts either by hand or machine Section 02 51 00.  
b. Unit of Measurement: Square Yard  
18. Unit Price No. 18: CR-6 stone base 6” price per SY.  
a. Description: Includes placement of stone in 6 inch lifts either by hand or machine as specified in Section 02 51 00.  
b. Unit of Measurement: Square Yard  
19. Unit Price No. 17: 6 Inch HDPE Storm  
a. Description: Includes installing storm sewer line and appurtenances, excavation, bedding, backfill and all incidentals in the indicated size as directed by the engineer as specified in Section 02 63 00.  
b. Unit of Measurement: Linear Foot  
20. Unit Price No. 20: 8 Inch HDPE Storm  
a. Description: Includes installing storm sewer line and appurtenances, excavation, bedding, backfill and all incidentals in the indicated size as directed by the engineer as specified in Section 02 63 00.  
b. Unit of Measurement: Linear Foot  
21. Unit Price No. 21: 12 inch HDPE  
a. Description: Includes installing storm sewer line and appurtenances, excavation, bedding, backfill and all incidentals in the indicated size as directed by the engineer as specified in Section 02 63 00.  
b. Unit of Measurement: Linear Foot  
22. Unit Price No. 22: Removal of Concrete Slab  
a. Description: Provide the cost to saw cut, remove and dispose of 5” concrete slab.  
b. Unit of Measurement: Per Square Foot  
23. Unit Price No. 23: Installation of 5” Concrete Slab  
a. Description: Provide the cost to materials, labor, taxes, overhead and profit and all other associated costs to install and finish 5” (3500 psi) concrete slab with mesh reinforcement, 10 mil vapor barrier and 5” aggregate base.  
b. Unit of Measurement: Per Square Foot
1.4 CASH ALLOWANCES

A. Costs Included in Cash Allowances: Cost of product to Contractor or Subcontractor, less applicable trade discounts; delivery to site, installation and applicable taxes.

B. Costs Not Included in Cash Allowances but Included in Contract Sum/Price: General Contractor overhead, profit and bond.

C. Architect/Engineer Responsibilities:
   1. Consult with Contractor for consideration and selection of products, and suppliers.
   2. Select products in consultation with Owner and transmit decision to Contractor.
   3. Prepare Change Order.

D. Contractor Responsibilities:
   1. Assist Architect/Engineer in selection of products, suppliers and installers.
   2. Obtain proposals from suppliers and installer and offer recommendations.
   3. On notification of selection by Architect/Engineer, Owner, execute purchase agreement with designated supplier and installer.
   4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
   5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.

E. Differences in costs will be adjusted by Change Order.

F. Allowances Schedule:
   1. Allowance No. 1: Exterior Building and Site Signage. $10,000.00
      a. Provide a $10,000 Allowance in the Base Bid for the procurement and installation of Exterior Building and site signage to include building address and numbers. Also included is the Directional Site Signage (Section 10441) as selected by the Owner and Architect during construction that is not included in the contract documents. Note that the structure for the building site signage is included in the Base Bid.

   2. Allowance No. 2: Dedication Plaque (Section 104410) $5,000.00
      a. Provide a $5,000 Allowance in the Base Bid for the procurement and installation of Dedication Plaque as selected by the Owner and Architect during construction that is not included in the contract documents.

   3. Allowance No. 3: Interior Signage (Section 104410) $10,000.00
      a. Provide a $10,000 Allowance in Base Bid for the procurement and installation of Interior Signage as selected by the Owner and Architect during construction that is not included in the contract documents.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION
SECTION 01 27 00 - APPLICATIONS FOR PAYMENT

PART 1   GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of Applications for Payment.

1.02 RELATED SECTIONS

A. Section 00 72 13 - General Conditions: Progress Payments and Final Payment.

B. Section 00 52 13 - Contract Agreement: Contract Sum/Price and amounts of Progress Payments and Retainages time schedule for submittals.

C. Section 01 20 00 - Price and Payment Procedures: Schedule of Values.

D. Section 01 28 00 - Change Order Procedures: Procedures for changes to the Work.

E. Section 01 33 00 - Submittal Procedures.

F. Section 01 73 00 - Execution Requirements: Final Payment.

1.03 FORMAT

A. AIA Form G702 – Application and Certification for Payment and G703 – Continuation Sheet.

B. Address applications to Washington County Public Schools.

C. For each item, provide a column for listing: Item Number; Description of work; Scheduled Value, Previous Applications: Work in Place and Site Stored Materials under this Application; Total Completed and Stored to Date of Application; Percentage of Completion; Balance to Finish; and Retainage.

D. Utilize Table of Contents to identify each line item with number and title of the major specification section.

E. The period covered by each application shall be projected through the end of the month.

1.04 PREPARATION OF APPLICATIONS

A. Present required information in typewritten draft form and submit via email no later than the 25th of each month.

B. Execute certification by signature of authorized officer.

C. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for site stored products.

D. List each authorized Change Order as an extension on continuation sheet, listing Change Order number and dollar amount as for an original item of Work.
E. The current IAC/PSCP Form 306.4 (MBE Attachment G) “Certified MBE Participation Standard Monthly Contractor’s Requisition for Payment” must be signed and included in each application for payment.

F. A partial lien waiver for previous payments must be signed, notarized, and included in each application for payment (lien waiver amount is to be cumulative).

G. Unless previously approved by the Owner, payments shall not be made for materials and/or equipment stored off the site. Requests must be made on an item by item basis and each request must be made well in advance of the pencil copy submission for the intended pay period.

H. Prepare Application for Final Payment as specified in Section 01 73 00.

1.05 SUBMITTAL PROCEDURES

A. Upon approval of each draft application, submit four (4) sealed originals of each Application for Payment no later than the last day of each month.

B. Submit an updated construction schedule with each Application for Payment.

C. Submit updated LEED information/narrative with each application for payment.

D. Payment Period: Submit at intervals stipulated in the Agreement.

1.06 OFF SITE STORED MATERIAL

A. Contractor shall comply with Article 9.3.2 in the AIA Document A201 – 1997 as amended by the Board of Education of Washington County for payment of stored materials.

B. WCPS supports contractors’ initiative to order material in advance so that it is ready when needed and contractors are permitted to bill for materials stored off-site. However, contractors must gain WCPS’ approval in advance to bill for off-site stored material and it is best if they start the process early when they know they want to include it on the next pay app. Stored materials and equipment will be considered on a case by case basis contingent upon each contractor’s compliance with procedures satisfactory to WCPS. A summary of the guidelines are as follows:

1. Materials/equipment must be project-specific and fabricated for subsequent incorporation in the work. Payment will not be approved for the storage of raw materials common to any construction project (sheet metal, studs, fasteners, etc.)

2. Materials/equipment must be properly identified on at least two sides for the specific project including the name of project, product/equipment identification, and location to be installed (i.e. Classroom 222, Corridor 020, etc.)

3. Materials/equipment must be stored in a secure location that provides suitable protection for the work and prevents diversion to another project. Contractor shall provide insurance documentation for the storage facility.

4. Materials/equipment must be available for inspection by WCPS and/or the Architect. Contractor shall coordinate with WCPS to arrange for a visit to the storage facility. WCPS has the option to request photos in lieu of visiting the storage facility.

5. Contractors are responsible for establishing Owner’s title to such materials and equipment and to otherwise protect the Owner’s interest and shall include applicable
insurance, storage, and transportation to the site for such materials and equipment stored off the site.

1.07 SUBSTANTIATING DATA

A. When Architect/Engineer requires substantiating information, submit data justifying dollar amounts in question.

B. Provide one copy of data with cover letter for each copy of submittal. Show Application number and date, and line item by number and description.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION
PART 1  GENERAL

1.01  SECTION INCLUDES

A.  Submittals.
B.  Documentation of change in Contract Sum/Price and Contract Time.
C.  Change procedures.
D.  Execution of change orders.
E.  Correlation of Contractor submittals.

1.02  RELATED SECTIONS

A.  Section 00 72 13 - General Conditions: Governing requirements for changes in the Work, in Contract Sum/Price, and Contract Time.
B.  Section 00 72 14 - General Conditions – WCPS Supplement: Percentage Allowances for Contractor's overhead and profit.
C.  Section 00 52 13 - Contract Agreement: Percentage allowances for Contractor's overhead and profit.
D.  Section 01 20 00 – Price and Payment Procedures: Schedule of Values.
E.  Section 01 27 00 - Applications for Payment.
F.  Section 01 35 10 - Sustainable Project Requirements.
G.  Section 01 60 00 - Material and Equipment: Product options and substitutions.
H.  Section 01 73 00 - Contract Closeout: Project Record Documents.

1.03  SUBMITTALS

A.  Submit name of the individual authorized to receive change documents and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.
B.  Change Order Forms: A.I.A. Form G701 - Change Order.

1.04  DOCUMENTATION OF CHANGE IN CONTRACT SUM/PRICE AND CONTRACT TIME

A.  Maintain detailed records of work done on a time and material basis. Provide full information required for evaluation of proposed changes, and to substantiate costs of changes in the Work.
B.  Document each quotation for a change in cost or time with sufficient data to allow evaluation of the quotation.
C.  Provide data to support computations including, but not limited to;
   1.  Quantities of products, labor, and equipment.
   2.  Taxes, insurance and bonds.
3. Overhead and profit.
5. Credit for deletions from Contract, similarly documented.

D. Support each claim for additional costs, and for work done on a time and material basis, with additional information:
   1. Origin and date of claim.
   2. Dates and times work was performed, and by whom.
   3. Time records and wage rates paid.
   4. Invoices and receipts for products, equipment, and subcontracts, similarly documented.

1.05 CHANGE PROCEDURES

A. The Architect/Engineer will advise of minor changes in the Work not involving an adjustment to Contract Sum/Price or Contract Time as authorized by AIA A201, 1997 Edition, Paragraph 7.4 by issuing supplemental instructions on AIA Form G710.

B. The Architect/Engineer may issue a Proposal Request which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor will prepare and submit an estimate within fourteen (14) working days.

C. The Contractor may propose a change by submitting a request for change to the Architect/Engineer, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum/Price and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 60 00.

D. Change Order Forms: Change Order Request Proposal attached at the end of this section.

1.06 EXECUTION OF CHANGE ORDERS

A. Execution of Change Orders: Architect/Engineer will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

1.07 CORRELATION OF CONTRACTOR SUBMITTALS

A. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum/Price.

B. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust time for other items of work affected by the change and resubmit.

C. Promptly enter changes in Project Record Documents

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION
Proposal Request Form

Project Name: 

Date: 

Proposal Request #: 

Prime Contractor: 

Subcontractor: 

Sub-Subcontractor: 

Proposal Scope (Include a brief description of the work)

<table>
<thead>
<tr>
<th>A. Labor, Materials, Equipment</th>
<th>$</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.1 Direct Payroll - wages less burden (no fringes, insurances, taxes, etc)</td>
<td>$</td>
<td>-</td>
</tr>
<tr>
<td>A.2 Material Cost</td>
<td>$</td>
<td>-</td>
</tr>
<tr>
<td>A.3 Equipment Rental</td>
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<td>-</td>
</tr>
<tr>
<td>A.4 Direct Equipment Cost</td>
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<td>-</td>
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Subtotal A - Labor, Materials, Equipment: $ - A

<table>
<thead>
<tr>
<th>B. Overhead &amp; Profit</th>
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<th>-</th>
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</thead>
<tbody>
<tr>
<td>Allowable Overhead &amp; Profit = (Subtotal A) x (% listed below)</td>
<td>$</td>
<td>-</td>
</tr>
<tr>
<td>15% $0.00 - $1,000</td>
<td>$</td>
<td>-</td>
</tr>
<tr>
<td>10% $1,001 - $5,000</td>
<td>$</td>
<td>-</td>
</tr>
<tr>
<td>7% $5,001 - $10,000</td>
<td>$</td>
<td>-</td>
</tr>
<tr>
<td>5% $10,001 - $25,000</td>
<td>$</td>
<td>-</td>
</tr>
<tr>
<td>over $25,000 negotiable not to exceed 5%</td>
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<td>-</td>
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</table>

Subtotal B - Overhead & Profit: $ - B

<table>
<thead>
<tr>
<th>C. Sales Tax (6% x (A.2 + A.3))</th>
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<th>-</th>
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</thead>
</table>

<table>
<thead>
<tr>
<th>D. Labor Burden</th>
<th>$</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>% x A.1</td>
<td>$</td>
<td>-</td>
</tr>
<tr>
<td>Must provide back-up to substantiate Labor Burden Rate</td>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>E. Subcontractor Cost</th>
<th>$</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subcontractor Cost (Provide detailed breakdown on separate form)</td>
<td>$</td>
<td>-</td>
</tr>
<tr>
<td>Allowable Prime Contractor Mark-Up (5% of Subcontractor Cost)</td>
<td>$</td>
<td>-</td>
</tr>
</tbody>
</table>

Subtotal E - Subcontractor Cost: $ - E

<table>
<thead>
<tr>
<th>F. Subtotal (A+B+C+D+E)</th>
<th>$</th>
<th>-</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>G. Bond (1% of F)</th>
<th>$</th>
<th>-</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>H. TOTAL COST = F + G</th>
<th>$</th>
<th>-</th>
</tr>
</thead>
</table>
PART 1  GENERAL

1.1  SECTION INCLUDES

A. Coordination and project conditions.
B. Field engineering.
C. Preconstruction meeting.
D. Site mobilization meeting.
E. Progress meetings.
F. Preinstallation meetings.

1.2  COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, submittals, and Work of various sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, operating equipment.

C. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.

E. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owner's partial occupancy.

F. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.3  FIELD ENGINEERING

A. The General Contractor shall employ a Land Surveyor registered in the State of Maryland and acceptable to Owner/Architect/Engineer.

B. Locate and protect survey control and reference points. Promptly notify Architect/Engineer of discrepancies discovered.
C. Control datum for survey is that shown on Drawings.

D. Verify set-backs and easements; confirm drawing dimensions and elevations.

E. Provide field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.

F. Submit copy of site drawing and certificate signed by Land Surveyor certifying elevations and locations of the Work are in conformance with Contract Documents.

G. Maintain complete and accurate log of control and survey work as Work progresses.

H. On completion of foundation walls and major site improvements, prepare certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

I. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

J. Promptly report to General Contractor loss or destruction of reference point or relocation required because of changes in grades or other reasons.

K. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect/Engineer.

1.4 PRECONSTRUCTION MEETING

A. The Owner/Architect will schedule meeting after Notice of Award.

B. Attendance Required: Owner, Architect/Engineer, and Contractor.

C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   4. Submission of list of Subcontractors, list of products, schedule of values, and progress schedule.
   6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Scheduling.
   9. Review LEED rating and credit criteria, processes and verification materials.

D. The Architect will record minutes and distribute copies within seven (7) days after meeting to major participants.

1.5 SITE MOBILIZATION MEETING

A. Owner/Architect will schedule meeting at Project site prior to Contractor occupancy.

B. Attendance Required: Owner, Architect/Engineer, Special Consultants, and Contractor, Contractor's Superintendent, and major Subcontractors.
C. Agenda:
   1. Use of premises by Owner and Contractor.
   2. Owner's requirements and partial occupancy.
   3. Construction facilities and controls provided by Owner.
   4. Temporary utilities provided by Contractor.
   5. Survey and building layout.
   7. Schedules.
   8. Application for payment procedures.
   9. Procedures for testing.
   11. Requirements for start-up of equipment.
   12. Inspection and acceptance of equipment put into service during construction period.

D. The Architect will record minutes and distribute copies within seven (7) days after meeting to participants.

1.6 PROGRESS MEETINGS

A. The Owner/Architect will schedule and administer meetings throughout progress of the Work at maximum two (2) week intervals.

B. The General Contractor will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required: Contractor, major subcontractors, Owner, Architect/Engineer, as appropriate to agenda topics for each meeting.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Review of Work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems impeding planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of off-site fabrication and delivery schedules.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period.
   10. Coordination of projected progress.
   11. Maintenance of quality and work standards.
   12. Effect of proposed changes on progress schedule and coordination.
   13. Other business relating to Work.

E. The Architect will record minutes and distribute copies within seven (7) days after meeting to participants.

1.7 PREINSTALLATION MEETING

A. When required in individual specification sections, the contractor shall convene preinstallation meeting at Project site prior to commencing work of specific section.

B. Require attendance of parties directly affecting, or affected by, Work of specific section.

C. Notify Owner/Architect/Engineer seven (7) days in advance of meeting date.
D. Prepare agenda and preside at meeting:
   1. Review conditions of installation, preparation and installation procedures.
   2. Review coordination with related work.

E. The Contractor will record minutes and distribute copies within seven (7) days after
   meeting to participants.

1.8 ELECTRONIC DOCUMENT PROCESSING SERVICE

A. To expedite the electronic review process, the contractor shall process all
   documents through a web-based software service.

B. Transmittal of documents via email, FTP or paper will not be accepted unless
   specifically noted elsewhere.

C. The web-based software shall provide an unlimited number of users added to the
   project by the Owner or Architect at no additional cost.

D. The web-based software shall provide status logs, reports, searching and
   automated notifications.

E. The web-based software shall include at a minimum the following modules:
   1. Submittals
   2. Submittal Register
   3. RFIs (Request for Information)
   4. Field Reports
   5. Draft Pay Applications
   6. Storage for Construction Documents and Specifications
   7. Revision Documents (ASI, CCD, PR, PCO, COR, CO, etc)
   8. Meeting Minutes
   9. Gantt charts and milestones

F. The web-based software shall provide integrated web-based markup tools. All
   users shall be able to markup a centralized file to eliminate redundancy of files.

G. The routing of the documents shall be automated, so the documents will
   automatically be sent to design team users based on trade or discipline.

H. The web-based software company shall provide a minimum of two training
   sessions per project by web conference.

I. The web-based software shall include a downloadable offline archive of all
   project data.

J. The web-based software shall provide tools for subcontractors to submit
   documents to contractor. Software must be capable of allowing contractor to
   review information before submitting to the design team and owner. It is at the
   contractor’s discretion if the subcontractor submits documents through the web-
   based software.

K. Color samples and other submittals requiring physical review shall be logged into
   the system and delivered by mail or courier.

L. Acceptable Providers
   1. Newforma Project Cloud (Basis of Design)
      a. Web Address: [www.newformaprojectcloud.com](http://www.newformaprojectcloud.com)
b. Phone: 800-303-4650
c. Email: projectcloud@newforma.com

2. Procore
   a. Web Address: www.procore.com
   b. Phone: 866-477-6267

3. Submittal Exchange
   a. Web Address: www.oracle.com
   b. Phone: 800-633-0738

4. Substitutions in accordance with Section 01 60 00

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION
PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. General Conditions of the Contract for Construction AIA Document A201-1997; specifically paragraphs, 3.10, 4.3.7, and Article 8.

B. Supplement to the General Conditions of the Contract for Construction AIA Document A201-1997; specifically paragraphs, 3.9.6, 3.10.1, 4.3.7.1, 4.3.7.3, 8.1.3, 8.2.4, and 8.3.1.

C. Division One of the Specifications

1.2 SUMMARY

A. Definitions

1. Activity: A discrete element of the Project that consumes time, uses resources, and can be used for planning, monitoring, and controlling the progress of the Work.

2. Constraint: A schedule software mechanism that when imposed on an activity overrides the existing logical relationship to other activities. Examples are: “start on”, “start no earlier”, “finish on, “finish no later”, etc.

3. CPM: The “Critical Path Method” of scheduling the work that determines the sequence and the time of performance of activities based on their logical connections.

4. Critical Path: The longest chain or chains of interconnected activities from the start of the first activity thru Final Completion.

5. Data Date: The date that is used for the mathematical calculation of the schedule for activities that have not been completed.

6. Float: “Free Float” is the time that an activity can be delayed before adversely affecting a successor activity. “Total Float” is the time that an activity can be delayed before adversely affecting the Critical Path of the Project.

7. Milestone: An element of the schedule having no duration that identifies the start or completion of activities or groups of activities in the schedule.

8. Predecessor: An activity that controls the start or finish of an activity that occurs later in the sequence of the schedule. That later activity is referred to as the “Successor” to the predecessor activity.

9. Recovery Schedule: A schedule that revises the sequence and or duration of uncompleted activities in order to overcome projected delays to the Substantial Completion Date or as determined by the existence of negative float for critical activities.

10. Restraint: The logical relationship between predecessors and successors such as: “start to start”, “finish to start”, or “finish to finish”.

12. Updated Schedule: A schedule that recalculates the balance of work to be performed from a previous schedule using a later data date, records the actual starts and actual finishes of activities that have progressed since the previous data date, and determines the remaining duration of activities in progress.

B. Quality Assurance
   1. If schedules are self-performed, Contractor will designate an individual or individuals with no less than 4 years experience preparing and managing CPM schedules for projects of comparable size and complexity as the Project.
   2. Alternatively, the Contractor may elect to retain the services of a consulting firm that specializes in the preparation and management of CPM schedules.
   3. Contractor’s submission of schedule to the Owner will indicate the Contractor’s complete review, approval, and accuracy of the submitted schedule.

C. Coordination
   1. CPM schedules will be coordinated and consistent with pay application schedule of values, submittal schedules, and other schedules and reports required under the Contract.
   2. Actual starts and finishes will be consistent with daily construction reports and other contemporaneous job records.

1.3 GENERAL REQUIREMENTS

A. This schedule specification is provided in order to provide the Owner with a tool with which to evaluate the reasonableness of the Contractor’s planning, assess implementation of the schedule, and to assist in the approval of progress payments.

B. Review of the Contractor’s schedules or reports by the Owner or Agents of the Owner does not modify the Contractor’s obligations under the Contract, and does not validate any of the data, assumptions, logic, or durations contained in the Contractor’s schedules or reports.

C. Review of the Contractor’s schedules does not provide any indication that the Owner or Agents of the Owner have agreed with the reasonableness of the Contractor’s planning or that the Project can be performed or completed as scheduled.

D. The Contractor has the duty to mitigate the impact of delays which may include resequencing work that is not affected by the delay.

E. A meeting will be held with the Contractor, Owner, and Architect when the Contractor has completed the Baseline Schedule to allow the Contractor to present the schedule. A suggested list of topics follows:
   1. Contractor’s overview of the network diagram structure including group coding structure and calendars used.
   2. Projected critical and near-critical paths.
   3. Contractor’s proposed identification of building areas for a clear and organized sequence of construction and for easy reference throughout construction. Present for review by Owner and A/E. Staging of equipment and materials.
   4. Key submittals and approvals that may impact progress.
5. Key subcontractors and vendors that may impact schedule.

6. Permits.

F. The schedule shall accurately reflect the Contractors construction means, methods, techniques, sequence and procedures. The Owner’s review of submitted schedules shall not be construed as limiting the Contractor’s means and methods to complete the Contract.

PART 2 PRODUCTS

2.1 NETWORK DIAGRAMS

A. General Requirements

1. Provide all schedules using the critical path method (CPM). All activities except the first activity will have predecessors. All activities except the Substantial Completion Date will have successors.

2. Only the first activity and the last activity are allowed to have constraints without the Owner’s written approval. The Substantial Completion Date as modified by executed change orders will have a “finish on or after” constraint.

3. Schedules will be calculated using the Retained Logic option provided by the scheduling software. The Progress Override option will not be used without the Owner’s written approval.

4. Primavera Version 6.0 (a product of the Oracle Corporation) will be used as the software for all schedules to facilitate review by the Owner. Alternative software proposed by the Contractor must be presented to, and approved by the Owner via addendum, during the bid process through specified procedures, in order to be accepted in lieu of Primavera Version 6.0.

5. Schedules will be submitted to Owner and Architect in accordance with Part 3, 3.2 Submittal Schedule of this Section.

6. Failure of the Contractor to provide acceptable Preliminary, Baseline, Update, or Recovery schedules within the time limits stated below shall be sufficient cause to withhold approval of the Contractor’s application for payment until the submitted schedule meets the specified requirements.

B. Preliminary Schedule

1. Provide a CPM schedule for activities planned for the first 60 cal. days of work.

2. Provide submission, review, fabrication and delivery activities for all work, especially key materials and equipment that affect the critical path and/or have long lead times.

3. Provide a summary bar chart for the balance of the Project. Constraints are allowed for this portion of the schedule.

C. Baseline Schedule

1. Provide a CPM from the date of the Notice to Proceed to Substantial Completion and Final Completion in sufficient detail to accurately reflect all distinct activities required to complete the Contract.
2. Durations
   a. If asked by the Owner, the Contractor shall be required to verify the reasonableness of the duration of specific activities based on the scheduled value of labor and projected crew sizes.
   b. Anticipated lost days, as specified in 4.3.7.3 of the Supplement to the General Conditions of the Contract for Construction AIA Document A201-1997, due to adverse weather are to be included in activity durations.

3. Activities to include at a minimum:
   a. Submittal, review, and fabrication activities for all work that may be delayed by fabrication, procurement, or other long lead times.
   b. Installation by group code.
   c. Sediment and erosion control sequence of construction.
   d. Equipment Startup.
   e. MEPS Commissioning.
   f. Inspections including foundations, wall and ceiling close-ins, and building and MEPS finals.
   g. Owner activities as required.
   h. Final building cleaning.

4. Group Codes- Provide as a minimum the following for each activity:
   a. Phase
   b. General Area (site general, site utilities, building, administrative, etc.)
   c. Specific Area (foundations, exterior, rough-ins, finishes, etc.)
   d. Responsibility (trade, subcontractor, vendor, Owner, Architect, etc.)

5. Milestones

6. Format
   a. Provide native files of all submitted schedules (for P6- “xer” file extensions)
   b. Network diagram.
      1) PDF in ledger size (11 x 17) in color.
      2) Critical Path bars- bright red.
   c. Tabular section
      1) Include ID, Description, original duration, remaining duration, early start and early finish columns.
      2) Either included predecessors and successors in columns or in a separate report.

D. Schedule Updates
   1. Update the previously submitted schedule by providing the following:
      a. Actual Starts
      b. Actual Finishes
      c. Remaining Duration for activities in progress
      d. Determine the Remaining Duration by the days required for completion, not the % complete of the Original Duration.

2. Submit the Updated Schedule without changes.

E. Schedule Revisions
   1. Provide all changes to the updated schedule in a separate submission to facilitate the Owner’s review including changes in activity duration, restraints, sequencing, group codes, added or deleted activities, or activity descriptions.
2. If the updated schedule projects a Substantial Completion Date more than 14 cal. days after the Substantial Completion Date, the Contractor shall provide a separate schedule that includes changes in logic or durations necessary to project a Substantial Completion Date in accordance with the Contract.

3. For substantial delays spanning multiple update periods provide a separate Recovery Schedule.

2.2 NARRATIVE REPORTS

A. Required for all updates and revised update submissions.

B. Include in each Narrative
   1. Discussion of current projected critical and near-critical paths.
   2. Listing of critical work days lost due to adverse weather conditions.
   3. Significant changes proposed and included in the revised update.
   4. Discussion of potential delays to remaining work.

PART 3 EXECUTION

3.1 GENERAL

A. Provide submittals in accordance with the Specification Division One requirements and Part 3, 3.2 Submittal Schedule of this Section. Section 01 32 30 shall supersede all other contract documents for any differences or ambiguity in Schedule submittal requirements within the contract documents.

3.2 SUBMITTALS SCHEDULE

A. Preliminary Schedule- 2 weeks from the NTP
B. Baseline Schedule- 6 weeks from the NTP
C. Updated Schedules- Monthly, 7 cal. days prior to the submission of pay applications.
D. Revised Updated Schedules- Concurrently with the submission of schedule updates.
E. Recovery Schedules- Provide when critical path delays are substantial or span multiple update periods, or when requested by the Owner.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. All Bid Documents, including, but not limited to: Drawings and general provisions of the Contract, including Instructions to Bidders, Supplemental Instructions to bidders, General Conditions, Supplementary Conditions, Addenda and Division 1 of these Specifications Sections, apply to this section.

1.2 SUMMARY

A. This Section includes the following:
   1. Shop Drawings
   2. Product Data
   3. Samples
   4. Color/Pattern Selection
   5. Maintenance/Operation Manuals
   6. Warranties/Bonds
   7. Other submittals required by the Contract Documents, and re-submittals necessary to establish compliance with the specified requirements.
   8. Submittal cover sheet.

B. Related Sections: Individual requirements for submittals also may be described in pertinent Sections of these Specifications; the following sections contain requirements that relate to this section.
   1. Section 01 20 00 - Price and Payment Procedures
   2. Section 01 31 00 - Administrative Requirements
   3. Section 01 40 00 - Quality Requirements
   4. Various Sections - Warranties

1.3 DEFINITIONS

A. General: Work-related submittals of this section are categorized for convenience as follows, but not limited to:
   1. Shop Drawings: Include specially-prepared technical data for this Project, including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements and similar information not in standard print for general application to a range of similar projects.
   2. Product Data: Includes standard printed information on materials, products and systems; not specially-prepared for this project, other than the designation of selections from among available choices printed therein.
   3. Samples: Includes both fabricated and un-fabricated physical examples of materials, products and units of work; both as complete units and as smaller portions of units of work; either for limited visual inspection or (where indicated) for more detailed testing and analysis.
   4. Mock-Ups: Are a special form of samples, which are too large or otherwise inconvenient for handling in specified manner for transmittal of sample submittals.

1.4 QUALITY ASSURANCE

A. Coordination of Submittals:
   1. Prior to each transmittal of a submittal, carefully review, verify and coordinate all aspects of each item being submitted.
   2. Verify that each item and the submittal for it conform in all respects with the specified requirements.
3. Each copy of all submittals shall bear the required Contractor’s Certification Stamp indicating that his review, verification and coordination has been performed.

4. Any submittals not bearing said stamp will be returned to the Contractor for re-submission without further consideration, in such event, it will be deemed that the Contractor has not complied with this requirement and that the Contractor shall bear the risk of all delays to the same extent as if no submittal had been made.

5. Identification of Submittals: Place a copy of the submittal cover sheet on each copy of all submittals for identification. At minimum on the cover sheet indicate the:
   a. Project name
   b. Date
   c. The name of the Contractor that prepared the submittal
   d. Specification Section Number, Title and item reference within, if applicable
   e. Submittal Identification Number comprised of Section Number and Sequential Number (example 15 00 00 – 001).
   f. Drawing sheet number and detail reference(s), designation(s)
   g. Any submittals that do not include the required cover sheet shall be returned to the Contractor for resubmission.

6. Submittal Transmittal Requirements:
   a. Submit original
   b. Identify items from only one Division of the Contract Documents on each transmittal, i.e. do not list items from Division 8 and 9 on the same transmittal.

7. Resubmittals:
   a. Provide resubmittal suffix; the original submittal number on your new transmittal, eg. Resubmittal of “15 00 00-001” identified as “15 00 00-001R”.

1.5 CONTRACTORS RESPONSIBILITIES

A. Contractors responsibilities for compliance with the requirements of Contract Documents is not relieved by Architects/Consulting Engineer’s review of submittals

B. Notify Architect, in writing at time of submittal, of any deviations from requirements of Contract Documents.

C. Begin no work which requires submittals until return of submittals with Architect/Consulting Engineer’s stamp and initials or signature indicating review.

D. After Architect/Consulting Engineer’s review, the General Contractor will distribute submittal copies to involved Contractors. Contractors shall ascertain that they have received all submittal information to properly execute and coordinate their work.

E. When a shop drawing or other submittal must be resubmitted by the Contractor, no changes other than those required as a result of the previous submission shall be made without the Architect/Consulting Engineer being made aware of the change. If such changes are made without so advising the Architect/Consulting Engineer, the Contractor will assume all responsibility for the possible consequences.

F. No portion of the work requiring a shop drawing, sample, or catalog data shall be started nor shall any materials be fabricated or installed prior to the review of such item.

1.6 PROCESSING OF SUBMITTALS

A. Shop Drawings, Product Data and Samples:
   1. The Contractor shall, within forty-five (45) calendar days (or sooner, if required elsewhere in the Contract Documents) after receiving the Owner’s signed Contract, Notice to Proceed, or “Letter of Intent”, forward all submittals to the Architect for review and/or approval.
   2. Transmittal of Submittals:
      a. Transmit each submittal from Contractor to Architect using a transmittal form.
b. Record on transmittal form deviations from Contract Documents requirements, including minor variations and limitations. Include the Contractor’s Certificate that the information complies with the Contract Document’s requirements.

1.7 CONTRACTORS “SUBMITTAL STAMP”

A. Representation: By his submittal of any shop drawings, samples, and product data, the Contractor thereby represents that he has determined and verified all field measurements, field construction criteria, materials dimensions, catalog numbers and similar data, or will do so; and that he has checked and coordinated each item with other applicable approved shop drawings and the Contract Documents requirements.

B. The Contractor shall stamp all shop drawings, samples and product data with the following certification:

“I certify that the specification requirements have been met and all dimensions, conditions and quantities are verified as shown and/or corrected on this submittal.”

Signed:
(For) Contractor

Date:

C. Submittals received without the above certification will be returned, not reviewed.

1.8 SUBSTITUTION REJECTION

A. If a non approved substitution is submitted, it will be returned “Submit Specified Item”. Only previously approved substitutions will be reviewed. Refer to Section 01 60 00 for substitution request procedures.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.1 SHOP DRAWINGS

A. Before submitting shop drawings for the Architect’s review, the Contractor shall check them for accuracy, shall ascertain that all work contiguous with and having bearing on other work shown on shop drawings is accurately drawn and that the work is in conformity with the Contract Document requirements.

1. The submission of shop drawings or re-submission of corrected shop drawings constitutes evidence that the Contractor accepts and is willing to perform the work as shown, in a workmanlike manner, and in accordance with the best standard practice.

2. Verify:
   a. Field measurements
   b. Field construction criteria
   c. Catalog numbers and similar data
   d. Coordination with integral and adjacent components.

B. Types of prints and copies required:

1. Submit electronic (PDF) files of each required Shop Drawings indicating accurately and in scale sufficiently large enough to show all pertinent aspects of the item and its method of connection to the work.
2. Review comments of the Architect or his Consultant Engineer will be shown on the returned files. The General Contractor will print copies from the electronic file for his needs.
3. The Architect/Consulting Engineers distribute the shop drawings for the Owner and their use.
4. Electronic files shall be labeled to match the submittal number.

C. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

D. Copies of approved shop drawings shall be maintained on site.

3.2 PRODUCT DATA
A. Before submitting product data for Architect’s review the Contractor shall assemble the Product Data into a single electronic submittal for each element of construction or system, including printed formation such as manufacturer’s installation instructions, catalog cuts, color charts, letter of certification, roughing-in diagrams and templates, standard wiring diagrams, performance curves, maintenance data, calculations and schedules.
   1. Provide three (3) original copies of color charts in addition to electronic copy.

B. Mark copy to show applicable choices and options. Where printed Product Data includes information on several products, mark copies to indicate those items being submitted.

C. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

3.3 SAMPLES
A. Before submitting samples to the Architect for approval, the Contractor shall assure himself that material represented thereby conforms to Contract Requirements and is readily available in the quantity required.

B. Provide samples identical to the precise article proposed to be provided.
   1. Identify as described in “Identification of Submittals”.
   2. Provide samples of the size required when a specific sample size is noted.

C. Number of samples required:
   1. Unless otherwise specified, submit four (4) sets of each sample.
   2. By prearrangement in specific cases, a single sample may be submitted for review and, when approved, be installed in the work at a location agreed upon by the Architect.

D. Field samples/mock-ups: Of sufficient size to clearly illustrate functional characteristics of product or material unless otherwise indicated by the projects Architect.
   1. Construct each complete, including work of all trades required in finished work.

3.4 COLORS, FINISH AND/OR PATTERN SELECTION
A. Submit the precise color and pattern that is specifically called out in the Contract Documents unless a choice of colors or patterns are requested.

B. Number of Copies Required:
   1. Submit four (4) color or pattern samples of each specified item requiring color and/or pattern selection.
3.5 ELECTRONIC BACKGROUNDS

A. If the Contractor and/or subcontractors require an electronic file (.DWG) of the construction documents, only plan backgrounds will be provided at a cost of $50.00 per file.
   1. Backgrounds will be released with no title blocks.
   2. Architect’s/Engineer’s drawings that are resubmitted as a shop drawing will be rejected.

B. Request must be made in writing to the Architect by the General Contractor.

C. Electronic files will not be released until a check is submitted made to the order of Bushey Feight Morin Architects.

3.6 RESUBMISSION REVIEWS

A. A maximum of two (2) reviews for each submittal will be provided by the Architect/Design Team.

B. If additional (or more) reviews are required, the Contractor will be invoiced on a time and material basis.
   1. The cost of additional reviews will be invoiced to the General Contractor with payment due in thirty (30) calendar days from the date of the invoice.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Quality control and control of installation.
B. Tolerances
C. References.
D. Mock-up requirements.
E. Testing and inspection services.
F. Manufacturers' field services.
G. Examination.
H. Preparation.

1.02 QUALITY CONTROL AND CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
B. Comply with manufacturers' instructions, including each step in sequence.
C. When manufacturers' instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
E. Perform Work by persons qualified to produce required and specified quality.
F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.
G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
C. Adjust products to appropriate dimensions; position before securing products in place.
1.04 REFERENCES

A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date for receiving bids, except where specific date is established by code.

C. Obtain copies of standards where required by product specification sections.

D. When specified reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

E. Neither contractual relationships, duties, nor responsibilities of parties in Contract nor those of Architect/Engineer shall be altered from Contract Documents by mention or inference otherwise in reference documents.

1.05 MOCK-UP REQUIREMENTS

A. Tests will be performed under provisions identified in this section and identified in respective product specification sections.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Accepted mock-ups shall be comparison standard for remaining Work.

D. Where mock-up has been accepted by Architect/Engineer and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so by Architect/Engineer.

1.06 TESTING AND INSPECTION SERVICES

A. Owner will employ and pay for specified services of an independent firm to perform testing and inspection.

B. The independent firm will perform tests, inspections and other services specified in individual specification sections and as required by Architect/Engineer.
   1. Laboratory: Authorized to operate at Project location.
   2. Laboratory Staff: Maintain full time registered Engineer, specialist on staff to review services.
   3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.

C. Testing, inspections and source quality control may occur on or off project site. Perform off-site testing as required by Architect/Engineer or Owner.

D. Reports will be submitted by independent firm to Owner/Contractor/Architect/Engineer and City of Hagerstown indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
   1. Notify Architect/Engineer and independent firm 48 hours prior to expected time for operations requiring services.
2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.

F. Testing and employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

G. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by same independent firm on instructions by Owner/Architect/Engineer. Payment for re-testing or re-inspection will be charged to Contractor by deducting testing charges from Contract Sum/Price. All non-conforming work shall be corrected immediately.

H. Agency Responsibilities:
1. Test samples of mixes submitted by Contractor.
3. Perform specified sampling and testing of products in accordance with specified standards.
4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
5. Promptly notify Architect/Engineer and Contractor of observed irregularities or non-conformance of Work or products.
6. Perform additional tests required by Architect/Engineer.

I. Agency Reports: After each test, promptly submit copies of typed report to Owner/Architect/Engineer/City of Hagerstown Inspector and to Contractor in PDF format. When requested by Architect/Engineer, provide interpretation of test results. Include the following:
1. Date issued.
2. Project title and number.
3. Name of inspector.
4. Date and time of sampling or inspection.
5. Identification of product and specifications section.
6. Location in Project.
7. Type of inspection or test.
8. Date of test.
9. Results of tests.
11. Sketches, photos, etc… as necessary to clarify location, layout, and conditions of work.

J. Limits On Testing Authority:
a. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
b. Agency or laboratory may not approve or accept any portion of the Work.
c. Agency or laboratory may not assume duties of Contractor.
d. Agency or laboratory has no authority to stop the Work.
A. When specified in individual specification sections, the Contractor shall make arrangements for material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Owner/General Contractor/Architect/Engineer 30 days in advance of required observations. Observer subject to approval of Owner.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

D. Provide reports documenting each manufacturer’s field services.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Verify utility services are available, of correct characteristics, and in correct locations.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

END OF SECTION
PART 1   GENERAL

1.01    SECTION INCLUDES
   A.  Requirements and limitations for cutting and patching of Work.

1.02    RELATED SECTIONS
   A.  Section 01 10 00 - Summary of Work: Work by Owner or by separate contractors.
   B.  Section 01 33 00 – Submittals Procedures.
   C.  Section 01 60 00 - Materials and Equipment: Product Options and Substitutions.
   D.  Individual Product Specification Sections:
       1.  Cutting and patching incidental to work of the Section.
       2.  Advance notification to other Sections of openings required in work of those Sections.
       3.  Limitations on cutting structural members.
       4.  Each specification section of the Work shall be responsible for their own cutting and patching as it relates to their work. It shall be noted that this statement is a revised clarification to the statement made at the Pre-Bid Conference.

1.03    SUBMITTALS
   A.  Submit written request in advance of cutting or alteration which affects:
       1.  Structural integrity of any element of Project.
       2.  Integrity of weather-exposed or moisture-resistant element.
       3.  Efficiency, maintenance, or safety of any operational element.
       5.  Work of Owner or separate contractor.
   B.  Include in request:
       1.  Identification of Project.
       2.  Location and description of affected work.
       3.  Necessity for cutting or alteration.
       4.  Description of proposed work, and products to be used.
       5.  Alternatives to cutting and patching.
       6.  Effect on work of Owner or separate contractor.
       7.  Written permission of affected separate contractor.
       8.  Date and time work will be executed.

PART 2   PRODUCTS

2.01    MATERIALS
   A.  Primary Products: Those required for original installation.
   B.  Product Substitution: For any proposed change in materials, submit request for substitution under provisions of Section 01 60 00.
PART 3  EXECUTION

3.01  EXAMINATION

A. Inspect existing conditions prior to commencing Work, including elements subject to 
damage or movement during cutting and patching.
B. After uncovering existing work, inspect conditions affecting performance of work.
C. Beginning of cutting or patching means acceptance of existing conditions.

3.02  PREPARATION

A. Provide temporary supports to ensure structural integrity of the Work. Provide devices 
and methods to protect other portions of Project from damage.
B. Provide protection from elements for areas which may be exposed by uncovering work.
C. Maintain construction free of water or other environmental exposure that may damage the 
work.

3.03  CUTTING AND PATCHING

A. Execute cutting, fitting, and patching including excavation and fill to complete work.
B. Fit products together, to integrate with other work.
C. Remove and replace defective or non-conforming work.
D. Remove samples of installed work for testing when requested.
E. Provide openings in the work for penetration of mechanical and electrical work.

3.04  PERFORMANCE

A. Execute work by methods to avoid damage to other Work, and which will provide 
appropriate surfaces to receive patching and finishing.
B. Employ original installer to perform cutting and patching for weather exposed and 
motion resistant elements, and sight-exposed surfaces.
C. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without 
prior approval.
D. Restore work with new products in accordance with requirements of Contract Documents.
E. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
F. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely 
seal voids with fire rated material to full thickness of the penetrated element.
G. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest 
intersection or natural break. For an assembly, refinish entire unit.

END OF SECTION
PART 1  GENERAL

1.1  SECTION INCLUDES

A.  Temporary Utilities:
   1.  Temporary electricity for building construction.
   2.  Temporary lighting for construction purposes.
   3.  Temporary heating for building construction.
   4.  Temporary ventilation for building construction.
   5.  Temporary utility services for field office.
   6.  Temporary water service for construction purposes.
   7.  Temporary sanitary facilities.

B.  Construction Facilities:
   1.  Field offices and storage containers.
   2.  Vehicular access.
   3.  Parking.
   4.  Progress cleaning and waste removal.
   5.  Project identification.

C.  Temporary Controls:
   1.  Barriers.
   2.  Enclosures and fencing.
   5.  Water control.
   6.  Dust control.
   7.  Erosion and sediment control.
   8.  Noise control.
   9.  Pest control.
  10.  Pollution control.
  11.  Rodent control.

D.  Removal of utilities, facilities, and controls.

1.2  RELATED SECTIONS

A.  Section 01 35 10 – Sustainable Design Requirements.

B.  Section 01 73 00 – Execution Requirements:  Final cleaning.

1.3  TEMPORARY ELECTRICITY FOR BUILDING CONSTRUCTION

A.  Provide and pay for power service required from utility source as needed for
construction operation.

B.  Provide temporary electric feeder from electrical service at location as directed by
the power company.

C.  Power Service Characteristics:  280/120 volt, 400 ampere, three phase, four wire.
D. Provide power outlets, with branch wiring and distribution boxes located as required for construction operations. Provide flexible power cords as required for portable construction tools and equipment. Contractor is responsible for furnishing, installing, maintaining, and redistributing adequate electrical service for all trades for construction purposes for the duration of the project as well as complete removal when temporary electrical service is no longer needed.

E. Provide main service disconnect and over-current protection at convenient location.

F. Permanent convenience receptacles may be utilized during construction.

G. All utility usage charges for permanent services during construction shall be by the Owner. All temporary services and usage charges required by the Contractor to perform their Work shall be arranged for and paid for by the Contractor.

1.4 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain incandescent lighting for construction operations to achieve minimum lighting level of 2 watt/sq.ft.

B. Provide and maintain 1 watt/sq. ft lighting to exterior staging and storage areas entire site after dark for security purposes.

C. Provide and maintain 0.25 watt/sq. ft HID lighting to interior work areas after dark for security purposes.

D. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps for specified lighting levels.

E. Maintain lighting and provide routine repairs. Include redistribution as necessary as work progresses as well as complete removal of temporary lighting.

F. Permanent building lighting may be utilized during construction if properly protected from dust or damage.

1.5 TEMPORARY HEATING FOR BUILDING CONSTRUCTION

A. The permanent HVAC equipment SHALL NOT be used for climate control until after the final building cleaning has been completed and only immediately before the commencement of commissioning and testing & balancing activities. Refer to HVAC specification section 23 05 00 for further direction regarding the startup of permanent HVAC equipment.

B. Provide and pay for heating devices and heat as needed to maintain specified conditions for construction operations.

C. Enclose building prior to activating temporary heat in accordance with Enclosures article in this section.

D. Maintain minimum ambient temperature of 50 degrees F. in areas where construction is in progress, unless indicated otherwise in product sections.

E. Temporary connection to the permanent natural gas service is acceptable for the purpose of supplying temporary heat in the building as long as contractor takes all safety precautions.
1.6 TEMPORARY VENTILATION FOR BUILDING CONSTRUCTION
A. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.7 TEMPORARY UTILITY SERVICES FOR FIELD OFFICE
A. Provide, maintain, and pay for power, phone, fax, and internet service to field office at time of project mobilization. Contractor is responsible for paying all connection fees, monthly use charges, and removal fees for utility services to temporary field office.

1.8 TEMPORARY WATER SERVICE FOR CONSTRUCTION PURPOSES
A. Provide and pay for suitable quality water service as needed to maintain specified conditions for construction operations. Connect to existing water source. Provide separate metering and pay for cost of water used until permanent water service is established.

B. General Contractor will pay cost of temporary water hook-up and usage. Exercise measures to conserve energy. Utilize Owner's new water system, extend and supplement with temporary devices as needed to maintain specified conditions for construction operations.

C. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing.

1.9 TEMPORARY SANITARY FACILITIES
A. Provide and maintain required facilities and enclosures. Provide facilities at time of project mobilization. Maintain daily in clean and sanitary condition.

B. Permanent facilities may not be used during construction operations.

C. At end of construction, remove temporary facilities used for construction operations. Return site to original condition or as scheduled.

1.10 FIELD OFFICES AND STORAGE CONTAINERS
A. Office: Weather tight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture drawing rack, drawing display table and file cabinet.

B. Provide space for Project meetings, with table and chairs to accommodate 20 persons.

C. Locate offices and storage containers and dumpsters a minimum distance of 50 feet from new structures. The Contractor shall coordinate with the Owner to identify mutually agreeable locations for the field office, storage area and containers, and dumpster locations at the pre-construction meeting.

D. Contractor offices shall not be located inside the school building.

E. Storage Areas and Sheds: Size to storage requirements for products of individual Sections, allowing for access and orderly provision for maintenance and for inspection of products to requirements of Section 01 60 00.
F. Preparation: Fill and grade sites for temporary structures sloped for drainage away from buildings.

G. Installation:
1. Install office spaces ready for occupancy by date of mobilization.
2. Parking: stone surfaced parking areas are to include space for use by Owner and Architect/Engineer. Maintain approach walks free of mud, water, and snow.
3. Employee Residential Occupancy: Not allowed on Owner's property.
4. Contractor is responsible for all associated service agreements and rental fees, permits, ADA compliance, insurance, security, utilities, furniture, equipment, supplies, delivery, setup and removal, cleaning, and maintenance associated with the field office.

H. Removal: At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

1.11 VEHICULAR ACCESS

A. Construct and maintain temporary all-weather access roads from public thoroughfares to serve construction area, of width and load bearing capacity to accommodate unimpeded traffic for construction purposes.

B. Construct temporary bridges and culverts to span low areas and allow unimpeded drainage.

C. Extend and relocate vehicular access as Work progress requires, provide detours as necessary for unimpeded traffic flow.

D. Location as indicated on Drawings.

E. Provide unimpeded access for emergency vehicles. Maintain 30 feet wide driveways with turning space between and around combustible materials.

F. Provide and maintain access to fire hydrants and control valves free of obstructions.

G. Provide means of removing mud from vehicle wheels before entering streets.

H. Use designated on-site roads for construction traffic.

1.12 PARKING

A. Construct and maintain temporary gravel surface parking areas to accommodate construction personnel.

B. Locate as indicated on Drawings or approved by Owner/Architect/Engineer.

C. When site space is not adequate, provide additional off-site legal parking.

D. Use of existing on-site streets and driveways used for construction traffic is not permitted. Tracked vehicles not allowed on paved areas.

E. Do not allow heavy vehicles or construction equipment in parking areas.

F. Do not allow vehicle parking on existing pavement.
G. Designate three (3) parking space for Owner, Architect/Engineer.

H. Permanent Pavements and Parking Facilities:
1. Prior to Substantial Completion, bases for permanent roads and parking areas may be used for construction traffic.
2. Avoid traffic loading beyond paving design capacity. Tracked vehicles not allowed.
3. Use of permanent parking structures is permitted after receipt of written approval from the Owner.

I. Maintenance:
1. Maintain traffic and parking areas in sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
2. Maintain permanent paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

J. Removal, Repair:
1. Remove temporary materials and construction prior to paving surface course.
2. Remove underground work and compacted materials to depth of 2 feet; fill and grade site as specified.
3. Repair permanent facilities damaged by use, to specified condition.

K. Mud from Site Vehicles: Provide means of removing mud from vehicle wheels before entering streets.

1.13 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing spaces.

C. Broom and vacuum clean interior areas prior to start of surface finishing and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and rubbish from site weekly and dispose off-site.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.14 TRAFFIC REGULATION

A. Signs, Signals, And Devices:
1. Post Mounted and Wall Mounted Traffic Control and Informational Signs: As approved by authority having jurisdiction.
2. Traffic Control Signals: As approved by local jurisdictions.
3. Traffic Cones and Drums, Flares and Lights: As approved by authority having jurisdiction.
4. Flag person Equipment: As required by authority having jurisdiction.

B. Flag Persons: Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.
C. Flares and Lights: Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

D. Haul Routes:
   1. Consult with authority having jurisdiction, establish public thoroughfares to be used for haul routes and site access.
   2. Confine construction traffic to designated haul routes.
   3. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.

E. Traffic Signs and Signals:
   1. Provide signs at approaches to site and on site, at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
   2. Provide, operate, and maintain traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control, and areas affected by Contractor's operations.
   3. Relocate as Work progresses, to maintain effective traffic control.

F. Removal:
   1. Remove equipment and devices when no longer required.
   2. Repair damage caused by installation.
   3. Remove post settings to depth of 2 feet

1.15 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.

B. Provide barricades and covered walkways required by authorities having jurisdiction for public rights-of-way.

C. Provide protection for plants and site features designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.16 ENCLOSURES AND FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 6 feet high fence around the entire construction site; equip with vehicular and pedestrian gates with locks. Promotional signs are not permitted on school property.

C. Exterior Enclosures:
   1. Provide temporary insulated weather tight closure of exterior openings in the building to accommodate acceptable working conditions and protection for products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.
1.17 SECURITY
A. Security Program:
   1. Protect Work from theft, vandalism, and unauthorized entry.
B. Entry Control:
   1. Restrict entrance of persons and vehicles into Project site.
   2. Allow entrance only to authorized persons with proper identification.
   3. Maintain log of workers and visitors, make available to Owner on request.

1.18 WATER CONTROL
A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

1.19 DUST CONTROL
A. Execute Work by methods to minimize raising dust from construction operations.
B. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

1.20 EROSION AND SEDIMENT CONTROL
A. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
B. Minimize surface area of bare soil exposed at one time.
C. Provide temporary measures including berms, dikes, and drains, and other devices to prevent water flow.
D. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
E. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

1.21 NOISE CONTROL
A. Provide methods, means, and facilities to minimize noise from equipment and noise produced by construction operations.

1.22 PEST CONTROL
A. Provide methods, means, and facilities to prevent pests and insects from damaging the Work.

1.23 POLLUTION CONTROL
A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.
B. Comply with pollution and environmental control requirements of authorities having jurisdiction.

1.24 RODENT CONTROL
   A. Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

1.25 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS
   A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.
   B. Remove temporary installed underground and above ground installations. Grade site as indicated on Drawings.
   C. Clean and repair damage caused by installation or use of temporary work.
   D. Restore permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 PRODUCTS
   (Not Used)

PART 3 EXECUTION
   (Not Used)

END OF SECTION
PART 1 GENERAL

1.1 RELATED DOCUMENTS
   
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 APPLICABLE PUBLICATIONS
   
   A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

   B. Code of Federal Regulations (CFR):

   C. Federal Standard (Fed. Std):
      1. 313A Material Safety Data Sheets, Preparation and the Submission of.

   D. Maryland Standards:
      1. Maryland Occupational Safety and Health (MOSH) Supplement to OSHA.

1.3 WORK COVERED BY THIS SECTION
   
   A. This section is applicable to all work.

   B. A Site-Specific Safety and Health Plan is to be developed by the Contractor and shall be adhered to in the execution of the work. The Plan shall include an overview of procedures, reports and samples of forms and documents for the plan. The contractor shall provide a copy of his safety plan to the Construction Manager.

1.4 DEFINITION OF HAZARDOUS MATERIALS
   
   A. Refer to hazardous and toxic materials/substances included in Subparts H and Z of 29 CFR 1910; and to others as additionally defined in Fed. Std. 313. Those most commonly encountered include asbestos, polychlorinated biphenyls (PCB’s), explosives, and radioactive material, but many include others. The most likely products to contain asbestos are sprayed-on fireproofing, insulation, boiler lagging, pipe covering and likely products to contain PCB’s are transformers, capacitors, voltage regulators, and oil switches.

1.5 QUALITY ASSURANCE
   
   A. Safety Meeting: Representatives of the Contractor shall meet with the Owner and his/her representative(s) prior to the start of work under this contract for the purpose or reviewing the Contractor’s safety and health programs and discussing implementation of all safety and health provisions pertinent to the work to be performed under the contract. The Contractor shall be prepared to discuss in detail, the measures he/she intends to take in order to control any unsafe or unhealthy conditions associated with the work to be performed under the contract. If directed by the Owner, this meeting may be held in conjunction with other meetings which are scheduled to take place prior to start of work under this contract. The level of detail for the safety meeting is dependent upon the nature of the work and the potential inherent hazards. The Contractor’s
principal on-site representative(s), the general superintendent and his/her safety representative(s) shall attend this meeting.

B. Compliance with Regulations: All work, including contact with and handling of hazardous materials, the disturbance or dismantling of structures containing hazardous materials and/or the disposal of hazardous materials shall comply with the applicable requirements of 29 CFR 1926/1910 and 40 CFR 761. All work shall comply with applicable state and municipal safety and health requirements. Where there is a conflict between applicable regulations, the most stringent shall apply.

C. Contractor Responsibility: The Contractor shall assume full responsibility and liability for compliance with all applicable regulations pertaining to the health and safety of personnel during the execution of work and shall hold the Owner harmless for any action on his/her part or that of his/her employees or subcontractors, which results in illness, injury or death.

D. Contractor shall conduct activities in a safe manner and shall be responsible for observing the safety regulations of MOSH, OSHA, and local life safety agencies.
   1. Comply with all applicable laws, ordinances, rules, regulations, and orders of the governing authorities having jurisdiction for safety of persons and property to protect them from damage, injury, or loss.
   2. Erect and maintain as required by conditions and progress of the work all necessary safeguards for safety and protection, including fences, railings, barricades, lighting, posting of danger signs, and other warnings against hazards.
   3. Be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with this project.
   4. Contractor shall immediately provide and maintain properly secured and labeled temporary protective covers over all deck and roof penetrations and openings until permanent work is installed.

E. Contractor shall furnish any and all relevant MSDS (Material Safety Data Sheets) information as related to their scope of work prior to starting. If not on file, this Contractor will not be permitted to work. Resulting delays and associated cost shall be the responsibility of this Contractor including costs incurred by other parties.

F. The General Contractor will require all contractors to complete a “Permit to Work” for high risk activities such as: crane erection and dismantling, entry into confined spaces, hot works, works on or adjacent to energized systems, and work on occupied premises. The Contractor shall present a Job Hazard Analysis and safe work method statement prior to the issuance of a Permit to Work. These items will be required in the project specific safety plan required for all Contractors.

G. All Contractors acknowledge that safety harnesses must only be used as a secondary means of fall prevention / fall restraint or as a last resort when no other practical means are available to provide a safe method of work. Passive fall protection such as safe work platforms, scaffolding, robust perimeter protection, and Mobile Elevated Work Platforms must be used wherever possible to prevent the use of safety harnesses as a primary means of fall protection.

H. Contractor shall conduct weekly tool box safety meetings and shall require all of their employees working on the site to attend. Copies of the minutes and attendance sheet must be submitted to the General Contractor weekly.

I. All Contractors shall provide proof of training and certification for all employees assigned to this project. Training must be relevant and updated for the scope of work or equipment being performed or operated by the individual tradesmen.
J. Contractor acknowledges that all employees are required to wear shirts, work shoes, and hard hats, safety glasses and high visibility vest at all times while on site. No shorts will be permitted.

K. Contractors shall install and maintain safety fence at all open excavations that they create.

L. Contractor shall exercise due care and shall be responsible for all material and accessories required for the safe rigging and handling of material and equipment so as to provide for the safety of persons and property, the work of other trades, and material and equipment stored at the jobsite.

M. Contractor shall replace any safety handrails and barriers taken down or removed during the process of their work.

1.6 SUBMITTAL

A. Site-Specific Safety and Health Plan: The Contractor’s Safety and Health Plan is to be submitted for approval during the initial submittals for the project.

B. Accident Reporting: A copy of each accident report, which the Contractors or subcontractors submit to their insurance carriers, shall be forwarded to the Owner as soon as possible, but in no event later than seven (7) calendar days after the day the accident occurred.

C. Permits: If hazardous materials are disposed of off-site, submit copies of permits from applicable, Federal, state or municipal authorities and necessary certificates that the material has been disposed of as per regulations.

D. Other Submittals: If agreed to in writing at the safety meeting, other submittals shall be required. One such submittal which may be included is a plan of action for handling hazardous materials, which shall contain the following:
   1. Number, type, and experience of employees to be used for the work
   2. Description of how applicable safety and health regulations and standards are to be met.
   3. Type of protective equipment and work procedures to be used
   4. Emergency procedures for accidental spills or exposures
   5. Procedures for disposing of or storing the toxic/hazardous materials
   6. Identification of possible hazards, problems, and proposed control mechanisms
   7. Protection of public or others not related to the operation
   8. Interfacing and control of subcontractors, if any
   9. Identifications of any required analyses, test demonstrations, and validation requirements.
   10. Method of certification for compliance

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Special facilities, devices, equipment, clothing, and similar items used by the Contractor in the execution of work shall comply with the applicable regulations.
the Contractor’s Field Office and made available for review when required.

3.2 SAFETY AND HEALTH PLAN

A. Site-Specific Safety and Health Plan: Post copies of the plan in conspicuous location so that all personnel may be made aware of the safety procedures at all times.

3.3 STOP WORK ORDERS

A. When the Contractors or his/her subcontractors are notified by the Owner/Architect of any noncompliance with the provisions of the contract and the action(s) to be taken, the Contractor shall immediately, if so directed, or within 48 hours after receipt of a notice of violation correct the unsafe or unhealthy condition. If the Contractor fails to comply promptly, all or any part of the work being performed may be stopped by the Owner/Architect with a “Stop Work Order”. When, in the opinion of the Owner/Architect, satisfactory corrective action has been taken to correct the unsafe and unhealthy condition, a start order will be given immediately. The Contractor shall not be allowed any extension of time or compensation for damages by reason of or in connection with such work stoppage.

3.4 PROTECTION

A. The Contractor shall take all necessary precautions to prevent injury to the public, or damage to property of others. For the purposes of this contract, the public shall include all persons not employed by the Prime Contractor’s or a subcontractor working under his/her direction.

B. Storing, positioning or use of equipment, tools, materials, scraps, and trash in a manner likely to present a hazard to the public by its accidental shifting, ignition, or other hazardous qualities is prohibited.

C. Public Thoroughfare: When work is to be performed over a public thoroughfare such as a sidewalk, the thoroughfare shall be closed, if possible, or other precautions taken such as the installation of screen or barricades. When the exposure to heavy falling objects exists, as during the erection of building walls, special protection of the type detailed in 29 CFR 1910/1926 shall be provided.

D. Fences and barricades shall be removed upon completion of the project, in accordance with local ordinance and to the satisfaction of the General Contractor.

END OF SECTION
PART 1    GENERAL

1.1    SECTION INCLUDES

A.    Products.

B.    Product delivery requirements.

C.    Product storage and handling requirements.

D.    Product options.

E.    Product substitution procedures.

1.2    PRODUCTS

A.    Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.

1.3    PRODUCT DELIVERY REQUIREMENTS

A.    Transport and handle products in accordance with manufacturer's instructions.

B.    Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

C.    Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.4    PRODUCT STORAGE AND HANDLING REQUIREMENTS

A.    Store and protect products in accordance with manufacturers' instructions.

B.    Store with seals and labels intact and legible.

C.    Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

D.    For exterior storage of fabricated products, place on sloped supports above ground.

E.    Provide bonded off-site storage and protection when site does not permit on-site storage or protection. Off-site storage must be located within the State of Maryland.

F.    Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

G.    Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

H.    Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

I.    Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.
J. Contractor must be on site to receive and unload all construction deliveries. WCPS staff is not responsible for receiving any deliveries for this construction project.

K. Limiting Exposure of Work: To extent possible through reasonable control and protection methods, supervise performance of work in a manner and by means which will ensure that none of the work, whether completed or in progress, will be subjected to harmful, dangerous, damaging, or otherwise deleterious exposures during construction period. Such exposures include where applicable (but not by way of limitation) static loading, dynamic loading, internal pressures, external pressures, high or low temperatures, thermal shock, high or low humidity, air contamination or pollution, water, ice, solvents, chemicals, light, radiation, puncture, abrasion, heavy traffic, soiling, bacteria, insect infestation, combustion, electrical current, high speed operation, improper lubrication, unusual wear, misuse, incompatible interface, destructive testing, misalignment, excessive weathering, unprotected storage, improper shipping/handling, theft and vandalism.

L. During handling and installation of work at project site, clean and protect work in progress and adjoining work on a basis of perpetual maintenance. Apply suitable protective covering on newly installed work where reasonably required to ensure work is free from damage or deterioration at time of substantial completion; otherwise, clean and perform maintenance on newly installed work as frequently as necessary through remainder of construction period.

M. Off Site Stored Materials shall be in accordance with Section 01 27 00.

1.5 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: products of one of manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with the following article.

1.6 PRODUCT SUBSTITUTION PROCEDURES

A. If the specification has listed three (3) or more product lines, substitutions will not be considered. Where less than three (3) manufacturers or products are listed in the Specifications, or the specification lists “Approved Equal” as an acceptable product, the burden of proof of equivalency rests with the Contractor and evidence shall be submitted to the Architect and approved by Architect with final approval to be determined by the Owner. Criteria includes but is not limited to performance, materials, craftsmanship, quality control, certification procedures or requirements, warranty, installation procedures, etc..

B. Any proposed substitution, or proposed equal product, must be submitted to the Architect for review, 10 days prior to the bid date. After the receipt of bids and award
of the Contract, the Owner and Architect are under no obligation to review or approve requests for substitution or equal products that were not specifically mentioned in the Specifications. The Owner reserves the right to request a substitution at any time in the project.

C. Substitutions may be considered during construction when a product becomes unavailable through no fault of Contractor at no additional cost to the Owner.

D. During construction, substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without prior separate written request, or approval, or when acceptance will require revision to Contract Documents.

E. Substitution Submittal Procedure:
1. Submit three (3) copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
3. Architect/Engineer will notify Contractor in writing of decision to accept or reject request.
4. If a substitution is found acceptable, the Contractor shall be responsible for coordination among the trades. Any redesign by the Architect/Engineer required by the accepted substitution, will be completed on a time and material basis with the cost submitted to the Owner and credited to the Owner-Contractor contract sum.

G. If a substitution is requested during construction, and the original specified product is available, the Owner/Architect/Engineer may request the Contractor to submit substantiating purchase cost data for review.
1. If it is found that the Contractor is in receipt of a savings to his contract by the substituted product, the Owner/Architect/Engineer may request that the credit be passed through to the Owner and credited to the Owner-Contractor contract sum.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION
REQUEST FOR SUBSTITUTION

DATE OF REQUEST: ___________________________________________________________

PROJECT:     WCPS: Boonsboro High School – Auditorium & Stage Renovations

CONTRACTOR: _______________________________________________________________

TELEPHONE NO:  ____________________________________________________________

FACSIMILE NO: _____________________________________________________________

CONTACT:  _______________________________________________________________

CONTRACT PACKAGE: ________________________________________________________

1. Item for which substitution is being requested:
   _______________________________________________________________________

2. Reference Specification Section: ____________________________________________

3. Reference Drawing: _______________________________________________________

4. Reason for Substitution Request : ________________________ 
   _______________________________________________________________________

5. Product Comparison:
   Submit three copies of shop drawing, product data, color samples, utility requirements 
   and certified test results attesting to the proposed product equivalence.
   a. _____ Data substantiating compliance of proposed substitution with contract documents.
   b. _____ Product identification, manufacturer’s name, address and telephone number.
   c. _____ Manufacturer’s literature, warranty.
   d. _____ Full color selection, showing colors Architect may select without additional cost.
   e. _____ Samples
   f. _____ Warranty
   g. _____ References of product use.
   h. _____ Itemized comparison of proposed substitution with product or method specified. 
          Highlight all differences from specified item.
   i. _____ All items listed Section 01 60 00-1.6.
   j. _____ Cover letter stating benefits or equality of substitution and reason for substitution request.

6. If request is being submitted after the receipt of bids, attach price quotations of specified 
   product and substituted products.

01 60 00-4 PRODUCT REQUIREMENTS   WCPS: Boonsboro High School
Auditorium & Stage Renovations
PART 1  GENERAL

1.1 SECTION INCLUDES

A. Closeout procedures.
B. Final cleaning.
C. Demonstration and instructions.
D. Protecting installed construction.
E. Project record documents.
F. Operation and maintenance data.
G. Manual for materials and finishes.
H. Spare parts and maintenance products.
I. Product warranties and product bonds.

1.2 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected by the Contractor and governing agencies, and that Work is complete in accordance with Contract Documents and ready for Architect/Engineer's review.
   1. The contractor shall then request in writing a “closeout inspection” by the Owner/Architect and Consultants.
   2. Prior to the start of the closeout inspection, the Contractor shall have performed final cleaning of the area in accordance with Article 1.3 of this section.
   3. Upon completion of the closeout inspection, the Owner/Architect/Engineer shall compile their findings and comments into one (1) document and submit it to the Contractor for corrective work.
      a. If all parties are in agreement, this closeout inspection shall constitute “substantial completion” to that portion of building or site inspected.
      b. If the area inspected is found unacceptable by the Owner/Architect/Engineer, reinspection fees will be charged to the Contractor on a time and material basis.

B. Provide submittals to Owner/Architect/Engineer required by authorities having jurisdiction.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.3 FINAL CLEANING

A. Execute final cleaning by a cleaning contractor with minimum five (5) years documented experience prior to final project assessment.
B. Provide products and manufacturers in accordance with project specifications and in particular all LEED requirements. All cleaning products must be documented as having Zero (0) VOC content.

C. Clean surfaces free of dust, stains, labels, and similar noticeable distracting substances. The areas and items noted show general areas of work and shall not serve to limit this scope of work:
   1. Interior and exterior glass/glazing systems, including window sills and ledges
   2. All walls, floors, and exposed structural surfaces in all rooms, including stairwells and mechanical/electrical rooms and elevator cab.
   3. All wall tile and wall base
   4. All light fixtures, including lenses.
   5. Grilles and diffusers
   6. Doors, frames and hardware
   7. Lockers, fire extinguishers and cabinets, railings, and signage
   8. Dust and wipe down mechanical and electrical equipment including transformers and electrical panels in electrical and mechanical rooms and the mechanical penthouse.
   9. Clean all equipment, devices, and surfaces in the MDF and IDF Rooms using appropriate methods for this specialty electronic equipment.
   10. Dust and wipe down Casework, millwork and shelving both inside and out. Include both vertical and horizontal plastic laminate surfaces.
   11. Electrical wall devices: outlets, light switches, cover plates, etc.
   12. Restrooms – clean and disinfect all accessories, mirrors, surfaces, plumbing fixtures, wall tile, and floor tile.
   13. Kitchen – clean and disinfect all accessories, surfaces, fixtures, wall tile, floor tile, etc. to Health Department standards
   14. Dust and wipe down all marker boards, tack boards, tack strips and display cases, including frames and ledges.

D. Use cleaners and methods that will not damage, stain, scratch, discolor, dull, etc. surfaces in any way.

E. Remove temporary protection.

F. Vacuum all carpeted surfaces.

G. All areas will be subject to a final inspection and acceptance by the Owner.

H. VCT shall be cleaned according to tile manufacturer’s instructions for new VCT installation. Mop clean only avoiding excess water on floors. ALL STRIPPING AND WAXING WORK IS NOT INCLUDED IN THIS SCOPE AND WILL BE PROVIDED BY OWNER.

I. Replace filters of operating equipment.

J. Clean debris from roofs, gutters, downspouts, and drainage systems.

K. Clean site; sweep paved areas, rake clean landscaped surfaces.
L. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.4 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks after to date of Substantial Completion.

B. Demonstrate Project equipment and instruct in classroom environment located at site and instructed by qualified manufacturer's representative who is knowledgeable about the Project.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six (6) months.

D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at equipment designated location.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

G. Required instruction time for each item of equipment and system is specified in individual sections.

H. Each demonstration shall be digitally filmed by a professional camera crew.
   1. The filmed demonstration shall be professionally edited with titles, subtitles and sound in a manner that clearly illustrates the operation and maintenance of the equipment or systems being demonstrated.
   2. Each piece of equipment or systems that has been filmed shall be submitted on a DVD format that can be operated by the Owner’s standard equipment.
   3. Separate DVD’s shall be provided for each piece of equipment or system demonstrated with title of demonstration, date of demonstration, name of facility, name of Owner, General Contractor, Subcontractor, Equipment or System Manufacturer, Model Number of Equipment or System, Name of Consultant and Architect.
   4. Provide two (2) copies of each DVD in a case or in an indexed “D” ring binder labeled in accordance to Article 1.7.

1.5 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed Shop Drawings, Product Data, and Samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.
   7. Contractor Request for Information (RFI) and Architectural Supplemental Instructions (ASI).

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract drawings.

G. Submit documents to Architect/Engineer with claim for final Application for Payment.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit data bound in 8-1/2 x 11 inch text pages, three D side ring, 3 inch binders with durable clear view plastic cloth covers. All binders shall be the same color

B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.

C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
E. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions arranged by specification division and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Air and water balance reports.
      b. Certificates.
      c. Originals of warranties and bonds

F. Submit one (1) draft copy for Architect/Engineer review at 50% project time completion.
   1. Upon completion of review by the Architect/Engineer, the copy shall be returned to the Contractor for corrections.

G. Upon completion of corrections, the Contractor shall submit three (3) final copies of the Operation and Maintenance Data to the Architect/Engineer.

1.8 MANUAL FOR MATERIALS AND FINISHES

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

C. Submit one (1) draft copy at 50% project completion inspection. Draft copy be reviewed and returned, with Architect/Engineer comments. Revise content of document sets as required prior to final submission.

D. Submit three (3) sets of revised final volumes in final form within 10 days after final completion.

E. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Include information for re-ordering custom manufactured products.

F. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

H. Additional Requirements: As specified in individual product specification sections.

I. Include listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.9 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Package, label, and furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.

B. Deliver to and place in location as directed by Owner; obtain receipt prior to final payment.

C. Provide transmittals of materials turned over to owner, including quantity and descriptions for Owner sign off.

1.10 PRODUCT WARRANTIES AND PRODUCT BONDS

A. Warranty Duration: Refer to Section 00 72 14 for overall warranty duration and individual sections for specific product warranty durations.

B. Obtain warranties and bonds executed in triplicate by responsible subcontractors, suppliers, and manufacturers, within ten (10) calendar days after completion of applicable item of work. The effective date of the warranty shall be the date of Substantial Completion.

C. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.

D. Verify documents are in proper form, contain full information, and are notarized.

E. Co-execute submittals when required.

F. Include Table of Contents and assemble in three D size ring binder with durable plastic clear view cover.

G. Submit prior to final Application for Payment.

H. Time Of Submittals:
1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten (10) calendar days after acceptance.
2. Make other submittals within ten (10) calendar days prior to Closeout Inspection, prior to final Application for Payment.
3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten (10) calendar days after acceptance, listing date of acceptance as beginning of warranty or bond period.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparation and submittal.

B. Time and schedule of submittals.

1.02 RELATED SECTIONS

A. Section 00 02 00 - Invitation to Bid - Instructions to Bidders: Bid Bonds.

B. Section 00 30 00 - General Conditions: Performance Bond and Labor and Material Payment Bonds, Warranty, and Correction of Work.

C. Section 01 73 00 - Execution Requirements: Contract closeout procedures.

D. Individual Specifications Sections: Warranties required for specific products or Work.

1.03 FORM OF SUBMITTALS

A. Bind in commercial quality, 8-1/2 x 11 inch three “D”-ring ‘clear-vue’ binders with hardback, cleanable, and transparent plastic covers and side binder.

B. Label cover and side of each binder with typed or printed title WARRANTIES AND BONDS, with title and date of Project; name, project number; address and telephone number of Contractor; and name of Architect.

C. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification Section in which specified, and the name of the product or work item.

D. Directory: Provide a directory which indicates names, addresses and telephone/fax numbers of Owners, Consultants, General Contractors, Subcontractors, and Major Suppliers. Include name of contact person for each entry.

E. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal. Include information regarding maintenance and operations of equipment and or materials as may be required by the specifications or manufacturer.

1.04 PREPARATION OF SUBMITTALS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item or work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.
D. Retain warranties and bonds until time specified for submittal.

1.05 TIME OF SUBMITTALS

A. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.

B. Provide draft copy of warranties and bonds for review by consultant no later than 50% project time completion.

C. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.

D. For items of Work when acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION
DIVISION 2

SITE WORK
PART 1 GENERAL

1.1 RESPONSIBILITY

A. A subsurface soil investigation has not been performed for this project. The Contractor shall excavate to the grades, slopes, lines, and levels indicated irrespective of the materials encountered with no increase in the contract cost to the Owner.

B. The Contractor is responsible for excavation and removal of all unclassified and unsuitable soils as indicated in the Contract Documents and to a maximum of twelve (12) inches below the subgrade identified in the Contract Documents. Above or below that threshold, work will be handled on a unit cost basis as identified in Section 01 20 00- Price and Payment Procedures.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Demolishing designated structures.
   2. Demolishing designated foundations.
   3. Demolishing designated slabs-on-grade.
   4. Disconnecting and capping designated utilities.
   5. Demolishing designated underground tanks.
   6. Removing designated items for Owner’s retention.
   7. Protecting items designated to remain.
   8. Removing demolished materials.

B. Related Sections:
   1. Section 02 22 30 - Backfilling: Backfill materials.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate demolition and removal sequence and location of salvageable items; location and construction of barricades, fences, and temporary work.

C. Design Data: Submit calculations for bracing, shoring, and underpinning signed and sealed by professional engineer.

D. Existing Building Documentation: Submit the following for existing buildings indicated to remain.
   1. Survey indicating position and elevation of exterior building features.
   2. Photographic survey indicating conditions before, during, and after demolition work.

E. Submit copy of permits required by regulatory agencies for demolition and sidewalk and street closings.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 73 00 - Execution Requirements: Requirements for submittals.

B. Project Record Documents: Accurately record actual locations of capped utilities, and subsurface obstructions.

C. Operation and Maintenance Data: Submit description of system, inspection data, and parts lists.

1.4 QUALITY ASSURANCE

A. Conform to applicable code for demolition of structures, safety of adjacent structures, dust control, runoff control, disposal, and recycle.

B. Conform to applicable code for procedures when hazardous or contaminated materials are discovered.

C. Obtain required permits from authorities having jurisdiction.
D. Perform Work in accordance with State and City of Hagerstown standard.

E. Maintain one copy of each document on site.

1.5 QUALIFICATIONS

A. Demolition Firm: Company specializing in performing work of this section with minimum ten years documented experience.

B. Design shoring, bracing, underpinning under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Maryland.

1.6 PRE-INSTALLATION MEETINGS

A. Section 01 31 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.7 SCHEDULING

A. Section 01 32 30 - Network Analysis Schedules: Requirements for scheduling.

B. Schedule Work to precede with site excavation work.

C. Describe demolition removal procedures and schedule.

D. Perform Work between hours of 8:00 AM and 5:00 PM.

1.8 PROJECT CONDITIONS

A. Buildings indicated to be demolished will be vacated before start of Work.

B. Owner assumes no responsibility for actual condition of buildings to be demolished.

C. Notify Architect/Engineer upon discovery of hazardous materials.

D. Do not sell demolished materials on-site.

E. Maintain existing sidewalks to greatest extent possible.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXISTING BUILDING DOCUMENTATION

A. Document condition of adjacent structures and buildings indicated to remain.

B. Make arrangements with building owners and occupants to survey interior and exterior of existing buildings.

C. Employ land surveyor as specified in Section 01 33 00 - Submittal Procedures to provide following documentation:
1. Survey building exterior for position and elevation of principal elements before and after completion of demolition.

3.2 EXAMINATION

A. Examine existing buildings indicated to be demolished before demolition.
B. Determine where removals may result in structural deficiency or unplanned building collapse during demolition. Coordinate demolition sequence and procedures to prevent structures from becoming unstable.
C. Determine where demolition may affect structural integrity or weather resistance of adjacent buildings indicated to remain.
   1. Identify measures required to protect buildings from damage.
   2. Identify remedial work including patching, repairing, bracing, and other work required to leave buildings indicated to remain in structurally sound and weathertight and watertight condition.
D. Verify hazardous material abatement is complete before beginning demolition.

3.3 PREPARATION

A. Call Local Utility Line Information service at not less than seven working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.
B. Notify affected utility companies before starting work and comply with utility's requirements.
C. Do not close or obstruct roadways, sidewalks, and hydrants without permits.
D. Erect, and maintain temporary barriers and security devices including warning signs and lights, and similar measures, for protection of the public and existing improvements indicated to remain.
E. Protect existing features indicated to remain.
F. Prevent movement or settlement of adjacent structures. Provide bracing and shoring.
G. Test soils around underground tanks for contamination.

3.4 DEMOLITION REQUIREMENTS

A. Use of explosives is not permitted.
B. Conduct demolition to minimize interference with adjacent structures and occupancies.
C. Cease operations immediately when adjacent structures appear to be in danger. Notify Architect/Engineer. Do not resume operations until directed.
D. Conduct operations with minimum interference to public or private accesses to occupied adjacent structures. Maintain protected egress and access from adjacent structures at all times.
E. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon or limit access to their property.

F. Sprinkle Work with water to minimize dust. Provide hoses and water connections required for this purpose.

3.5 DEMOLITION

A. Disconnect remove and cap designated utilities to street connection. Identify utilities at termination of demolition. Record termination or capped location on Record Documents.

B. Remove foundation walls and footings to minimum of two feet below finished grade beyond area of new construction and within area of new construction.

C. Remove concrete slabs-on-grade.

D. Empty underground tanks located within demolition area.

E. Remove underground tanks, components, and piping from site.

F. Remove materials to be re-installed or retained in manner to prevent damage. Store and protect in accordance with requirements of Section 01 60 00 - Product Requirements.

G. Backfill areas excavated, open pits and holes resulting from demolition, in accordance with Section 02 32 00.

H. Rough grade and compact areas affected by demolition to maintain site grades and contours to accommodate subsequent construction operations.

I. Continuously clean-up and remove demolished materials from site. Do not allow materials to accumulate in building or on site.

J. Do not burn or bury materials on site. Leave site in clean condition.

END OF SECTION
PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. Refer to current publication(s) in all cases.

A. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
   1. ANSI Z88.2 - (current publication) Respiratory Protection

B. STATE OF MARYLAND CODE OF MARYLAND REGULATIONS (COMAR)
   1. COMAR 26.13 - (current publication) Chapters .01-.13, Disposal of Controlled Hazardous Substances
   2. COMAR 26.16.01 - Accreditation and Training for Lead Paint Abatement Services
   3. COMAR 26.16.02 - Reduction of Lead Risk in Housing
   4. COMAR 26.16.03 - Procedures for Making and Implementing a Qualified Offer
   5. COMAR 26.16.04 - Verifiable Methods Approved by the Department
   6. COMAR 26.16.05 - Procedures for Performing Lead Abatement Services
   7. COMAR 26.16.06 - Lead in Children's Products

C. U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)
   1. HUD 6780 - (current publication) Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing

D. U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
   1. 29 CFR 1926.103 - Respiratory Protection
   2. 29 CFR 1926.21 - Safety Training and Education
   3. 29 CFR 1926.33 - Access to Employee Exposure and Medical Records
   4. 29 CFR 1926.55 - Gases, Vapors, Fumes, Dusts, and Mists
   5. 29 CFR 1926.59 - Hazard Communication
   6. 29 CFR 1926.62 - Lead
   10. 40 CFR 262 - Standards Applicable to Generators of Hazardous Waste
   11. 40 CFR 263 - Standards Applicable to Transporters of Hazardous Waste
   12. 40 CFR 264 - Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
   13. 40 CFR 265 - Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
   14. 40 CFR 268 - Land Disposal Restrictions
   15. 40 CFR 745 - Lead-Based Paint Poisoning Prevention in Certain Residential Structures
   17. 49 CFR 178 - Specifications for Packaging’s
E. UNDERWRITERS LABORATORIES (UL)
   1. UL 586 - (current publication) Standard for High-Efficiency Particulate, Air Filter Units

1.2 DEFINITIONS

A. Action Level: Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8 hour period.

B. Area Sampling: Sampling of lead concentrations within the lead control area and inside the physical boundaries which is representative of the airborne lead concentrations but is not collected in the breathing zone of personnel (approximately 5 to 6 feet above the floor).

C. Competent Person (CP): As used in this section, refers to a person employed by the Contractor who is trained in the recognition and control of lead hazards in accordance with current federal, State, and local regulations and has the authority to take prompt corrective actions to control the lead hazard. A Certified Industrial Hygienist (CIH) certified by the American Board of Industrial Hygiene or a Certified Safety Professional (CSP) certified by the Board of Certified Safety Professionals is the best choice.

D. Contaminated Room: Refers to a room for removal of contaminated personal protective equipment (PPE).

E. Decontamination Shower Facility: That facility that encompasses a clean clothing storage room, and a contaminated clothing storage and disposal rooms, with a shower facility in between.

F. High Efficiency Particulate Arrestor (HEPA) Filter Equipment: HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead-contaminated particulate. A high efficiency particulate filter demonstrates at least 99.97 percent efficiency against 0.3 micron or larger size particles.

G. Lead: Metallic lead, inorganic lead compounds, and organic lead soaps. Excludes other forms of organic lead compounds.

H. Lead Control Area: A system of control methods to prevent the spread of lead dust, paint chips or debris to adjacent areas that may include temporary containment, floor or ground cover protection, physical boundaries, and warning signs to prevent unauthorized entry of personnel. HEPA filtered local exhaust equipment may be used as engineering controls to further reduce personnel exposures or building/outdoor environmental contamination.

I. Lead Permissible Exposure Limit (PEL): Fifty micrograms per cubic meter of air as an 8 hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more than eight hours in a work day, the PEL shall be determined by the following formula: \[\text{PEL} (\text{micrograms/cubic meter of air}) = \frac{400}{\text{No. hrs worked per day}}.\]
J. Material Containing Lead/Paint with Lead (MCL/PWL): Any material, including paint, which contains lead as determined by the testing laboratory using a valid test method. The requirements of this section do not apply if no detectable levels of lead are found using a quantitative method for analyzing paint or MCL using laboratory instruments with specified limits of detection (usually 0.01 percent). An X-Ray Fluorescence (XRF) instrument is not considered a valid test method.

K. Personal Sampling: Sampling of airborne lead concentrations within the breathing zone of an employee to determine the 8 hour time weighted average concentration in accordance with 29 CFR 1926.62. Samples shall be representative of the employees’ work tasks. Breathing zone shall be considered an area within a hemisphere, forward of the shoulders, with a radius of 6 to 9 inches and centered at the nose or mouth of an employee.

L. Physical Boundary: Area physically roped or partitioned off around lead control area to limit unauthorized entry of personnel.

1.3 DESCRIPTION

A. Description of Work: Construction activities impacting PWL or material containing lead which are covered by this specification include the demolition and/or removal of material containing lead located on existing steel truss girder(s) and roof framing over Auditorium and Stage. Refer to drawings and specification Section 02 22 15.

B. Coordination with Other Work: The contractor shall coordinate with work being performed in adjacent areas. Coordination procedures shall be explained in the Plan and shall describe how the Contractor will prevent lead exposure to other contractors and/or Government personnel performing work unrelated to lead activities.

1.4 SUBMITTALS

WCPS approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal. The following shall be submitted:

A. Preconstruction Submittals
1. Occupational and Environmental Assessment Data Report (if objective data is used to justify excluding the initial occupational exposure assessment); G
2. Lead Compliance Plan including CP approval (signature, date, and certification number); G
3. Competent Person qualifications; G
4. Training Certification of workers and supervisors; G
5. Lead waste management plan; G
6. Written evidence that TSD is approved for lead disposal; G
7. Certification of Medical Examinations; G

B. Test Reports
1. Sampling results; G
2. Occupational and Environmental Assessment Data Report; G
C. Certificates
1. Testing laboratory qualifications; G
2. Occupant Notification; G
3. Third party consultant qualifications; G
4. Clearance Certification; G

D. Closeout Submittals
1. Completed and signed hazardous waste manifest from treatment or disposal facility; G.
2. Waste turn-in documents or weight tickets for non-hazardous wastes that are disposed of at sanitary or construction and demolition landfills; G

1.5 QUALITY ASSURANCE

A. Qualifications
1. Competent Person (CP): Submit name, address, and telephone number of the CP selected to perform responsibilities specified in paragraph entitled "Competent Person (CP) Responsibilities." Provide documented construction project-related experience with implementation of OSHA's Lead in Construction standard (29 CFR 1926.62) which shows ability to assess occupational and environmental exposure to lead, experience with the use of respirators, personal protective equipment and other exposure reduction methods to protect employee health. Submit proper documentation that the CP is trained and licensed in accordance with federal, State (COMAR 26.16.01) and local laws. The competent person shall be a licensed lead-based paint abatement Supervisor/Project Designer in the State of Maryland.

2. Training Certification: Submit a certificate for each worker and supervisor, signed and dated by the accredited training provider, stating that the employee has received the required lead training specified in 29 CFR 1926.62(l) and is certified to perform or supervise deleading, lead removal or demolition activities in the state of Maryland.

3. Testing Laboratory: Submit the name, address, and telephone number of the testing laboratory selected to perform the air and soil testing, and reporting of concentrations of lead. Use a laboratory participating in the EPA National Lead Laboratory Accreditation Program (NLLAP) by being accredited by either the American Association for Laboratory Accreditation (A2LA) or the American Industrial Hygiene Association (AIHA) and that is successfully participating in the Environmental Lead Proficiency Analytical Testing (ELPAT) program to perform sample analysis. Laboratories selected to perform blood lead analysis shall be OSHA approved.

4. Third Party Consultant Qualifications: Submit the name, address and telephone number of the third party consultant selected to perform the sampling for determining concentrations of lead in soil. Submit proper documentation that the consultant is trained and certified as an inspector technician or inspector/risk assessor by the USEPA authorized State (or local) certification and accreditation program.

B. Requirements
1. Competent Person (CP) Responsibilities
   a. Verify training meets all federal, State, and local requirements.
b. Review and approve Lead Compliance Plan for conformance to the applicable referenced standards.

c. Continuously inspect PWL or MCL work for conformance with the approved plan.

d. Perform (or oversee performance of) air sampling. Recommend upgrades or downgrades (whichever is appropriate based on exposure) on the use of PPE (respirators included) and engineering controls.

e. Ensure work is performed in strict accordance with specifications at all times.

f. Control work to prevent hazardous exposure to human beings and to the environment at all times.

g. Supervise final cleaning of the lead control area, take clearance wipe samples if necessary; review clearance sample results and make recommendations for further cleaning.

h. Certify the conditions of the work as called for elsewhere in this specification.

2. Lead Compliance Plan: Submit a detailed job-specific plan of the work procedures to be used in the disturbance of PWL or MCL. The plan shall include a sketch showing the location, size, and details of lead control areas, critical barriers, physical boundaries, location and details of decontamination facilities, viewing ports, and mechanical ventilation system. Include a description of equipment and materials, work practices, controls and job responsibilities for each activity from which lead is emitted. Include in the plan, eating, drinking, smoking, hygiene facilities and sanitary procedures, interface of trades, sequencing of lead related work, collected waste water and dust containing lead and debris, air sampling, respirators, personal protective equipment, and a detailed description of the method of containment of the operation to ensure that lead is not released outside of the lead control area. Include site preparation, cleanup and clearance procedures. Include occupational and environmental sampling, training and strategy, sampling and analysis strategy and methodology, frequency of sampling, duration of sampling, and qualifications of sampling personnel in the air sampling portion of the plan. Include a description of arrangements made among contractors on multicontractor worksites to inform affected employees and to clarify responsibilities to control exposures.

In occupied buildings, the plan shall also include an occupant protection program that describes the measures that will be taken during the work to notify and protect the building occupants.

3. Occupational and Environmental Assessment Data Report: If initial monitoring is necessary, submit occupational and environmental sampling results to the Contracting Officer within three working days of collection, signed by the testing laboratory employee performing the analysis, the employee that performed the sampling, and the CP.

In order to reduce the full implementation of 29 CFR 1926.62, the Contractor shall provide documentation. Submit a report that supports the determination to reduce full implementation of the requirements of 29 CFR 1926.62 and supporting the Lead Compliance Plan.
a. The initial monitoring shall represent each job classification, or if working conditions are similar to previous jobs by the same employer, provide previously collected exposure data that can be used to estimate worker exposures per 29 CFR 1926.62. The data shall represent the worker's regular daily exposure to lead for stated work.

b. Submit worker exposure data gathered during the task based trigger operations of 29 CFR 1926.62 with a complete process description. This includes manual demolition, manual scraping, manual sanding, heat gun, power tool cleaning, rivet busting, cleanup of dry expendable abrasives, abrasive blast enclosure removal, abrasive blasting, welding, cutting and torch burning where lead containing coatings are present.

c. The initial assessment shall determine the requirement for further monitoring and the need to fully implement the control and protective requirements including the lead compliance plan per 29 CFR 1926.62.

4. Medical Examinations: Initial medical surveillance as required by 29 CFR 1926.62 shall be made available to all employees exposed to lead at any time (1 day) above the action level. Full medical surveillance shall be made available to all employees on an annual basis who are or may be exposed to lead in excess of the action level for more than 30 days a year or as required by 29 CFR 1926.62. Adequate records shall show that employees meet the medical surveillance requirements of 29 CFR 1926.33, 29 CFR 1926.62 and 29 CFR 1926.103. Provide medical surveillance to all personnel exposed to lead as indicated in 29 CFR 1926.62. Maintain complete and accurate medical records of employees for the duration of employment plus 30 years.

5. Training: Train each employee performing work that disturbs lead, who performs MCL/PWL disposal, and air sampling operations prior to the time of initial job assignment and annually thereafter, in accordance with 29 CFR 1926.21, 29 CFR 1926.62, and State of Maryland and local regulations where appropriate.

6. Respiratory Protection Program:
   a. Provide each employee required to wear a respirator a respirator fit test at the time of initial fitting and at least annually thereafter as required by 29 CFR 1926.62.


8. Lead Waste Management: The Lead Waste Management Plan shall comply with applicable requirements of federal, State, and local hazardous waste regulations and address:
   a. Identification and classification of wastes associated with the work.
   b. Estimated quantities of wastes to be generated and disposed of.
c. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and operator and a 24-hour point of contact. Furnish two copies of USEPA, State and local hazardous waste permits and USEPA Identification numbers.

d. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.

e. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.

f. Spill prevention, containment, and cleanup contingency measures including a health and safety plan to be implemented in accordance with 29 CFR 1926.65.

g. Work plan and schedule for waste containment, removal and disposal. Proper containment of the waste includes using acceptable waste containers (e.g., 55-gallon drums) as well as proper marking/labeling of the containers. Wastes shall be cleaned up and containerized daily.

h. Include any process that may alter or treat waste rendering a hazardous waste non hazardous.

i. Unit cost for hazardous waste disposal according to this plan.

9. Environmental, Safety and Health Compliance: In addition to the detailed requirements of this specification, comply with all laws, ordinances, rules, and regulations of federal, State, and local authorities regarding lead. Comply with the applicable requirements of the current issue of 29 CFR 1926.62. Submit matters regarding interpretation of standards to the Contracting Officer for resolution before starting work. Where specification requirements and the referenced documents vary, the most stringent requirement shall apply.

C. Pre-Construction Conference: Along with the CP, meet with the WCPS to discuss in detail the Lead Waste Management Plan and the Lead Compliance Plan, including procedures and precautions for the work.

1.6 EQUIPMENT

A. Respirators: Furnish appropriate respirators approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, for use in atmospheres containing lead dust, fume and mist. Respirators shall comply with the requirements of 29 CFR 1926.62.

B. Special Protective Clothing: Furnish personnel who will be exposed to lead-contaminated dust with proper disposable protective whole body clothing, head covering, gloves, eye, and foot coverings as required by 29 CFR 1926.62. Furnish proper disposable plastic or rubber gloves to protect hands. Reduce the level of protection only after obtaining approval from the CP.

C. Rental Equipment Notification: If rental equipment is to be used during PWL or MCL handling and disposal, notify the rental agency in writing concerning the intended use of the equipment.

D. Vacuum Filters: UL 586 labeled HEPA filters.
E. Equipment for Authorized Visitors: Furnish the WCPS Representatives with two complete sets of personal protective equipment (PPE) daily, as required herein, for entry into and inspection of the lead removal work within the lead controlled area. Personal protective equipment shall include disposable whole body covering, including appropriate foot, head, eye, and hand protection. PPE shall remain the property of the Contractor. The Government will provide respiratory protection for the Contracting Officer.

1.7 PROJECT/SITE CONDITIONS

A. Protection of Existing Work to Remain: Perform work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition or better as determined by the Contracting Officer.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PREPARATION

A. Protection

1. Notification
   a. Notify the Contracting Officer 10 days prior to the start of any lead work.
   b. Occupant Notification: Submit occupant written acknowledgment of the delivery of lead hazard information pamphlet (EPA 747-K-99-001 "Protect Your Family From Lead in Your Home") and (EPA “The Lead-Safe Certified Guide to Renovate Right”) prior to commencing the renovation work for each affected unit using language provided in 40 CFR 745 Subpart E.

2. Lead Control Area
   a. Physical Boundary - Provide physical boundaries around the lead control area by roping off the area designated in the work plan or providing curtains, portable partitions or other enclosures to ensure that lead will not escape outside of the lead control area.
   b. Warning Signs - Provide warning signs at approaches to lead control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs shall comply with the requirements of 29 CFR 1926.62.

3. Furnishings: Removed

4. Heating, Ventilating and Air Conditioning (HVAC) Systems: Shut down, lock out, and isolate HVAC systems that supply, exhaust, or pass through the lead control areas. Seal intake and exhaust vents in the lead control area with 6 mil plastic sheet and tape. Seal seams in HVAC components that pass through the lead control area.

5. Decontamination Shower Facility: Provide clean and contaminated change rooms and shower facilities in accordance with this specification and 29 CFR 1926.62.
6. Eye Wash Station: Where eyes may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes shall be provided within the work area.


8. Personnel Protection: Personnel shall wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking or application of cosmetics is not permitted in the lead control area. No one will be permitted in the lead control area unless they have been appropriately trained and provided with protective equipment.

3.2 ERECTION

A. Lead Control Area Requirements: Establish a lead control area by completely establishing barriers and physical boundaries around the area or structure where PWL or MCL removal operations will be performed.

3.3 APPLICATION

A. Lead Work: Perform lead work in accordance with approved Lead Compliance Plan. Use procedures and equipment required to limit occupational exposure and environmental contamination with lead when the work is performed in accordance with 29 CFR 1926.62 or 40 CFR 745, and as specified herein. Dispose of all PWL or MCL and associated waste in compliance with federal, State, and local requirements.

B. Paint with Lead or Material Containing Lead Removal: Manual or power sanding or grinding of lead surfaces or materials is not permitted unless tools are equipped with HEPA attachments or wet methods. The dry sanding or grinding of surfaces that contain lead is prohibited. Provide methodology for removing lead in the Lead Compliance Plan. Select lead removal processes to minimize contamination of work areas outside the control area with lead-contaminated dust or other lead-contaminated debris or waste and to ensure that unprotected personnel are not exposed to hazardous concentrations of lead. Describe this removal process in the Lead Compliance Plan.
   1. Paint with Lead or Material Containing Lead - Indoor Removal: Perform manual and mechanical removal in the lead control areas using enclosures, barriers or containments and powered locally exhausted tools. Collect residue and debris for disposal in accordance with federal, State, and local requirements.
   2. Paint with Lead or Material Containing Lead - Outdoor Removal: Perform outdoor removal as indicated in federal, State, and local regulations and in the Lead Compliance Plan. The worksite preparation (barriers or containments) shall be job dependent and presented in the Lead Compliance Plan.

C. Personnel Exiting Procedures: Whenever personnel exit the lead-controlled area, they shall perform the following procedures and shall not leave the workplace wearing any clothing or equipment worn in the control area:
   1. Vacuum all clothing before entering the contaminated change room.
   2. Remove protective clothing in the contaminated change room and place them in an approved impermeable disposal bag.
   4. Change to clean clothes prior to leaving the clean clothes storage area.
3.4 FIELD QUALITY CONTROL

A. Tests
1. Air and Wipe Sampling: Conduct sampling for lead in accordance with 29 CFR 1926.62 and as specified herein. Air and wipe sampling shall be directed or performed by the CP.
   a. The CP shall be on the job site directing the air and wipe sampling and inspecting the PWL or MCL removal work to ensure that the requirements of the contract have been satisfied during the entire PWL or MCL operation.
   b. Collect personal air samples on employees who are anticipated to have the greatest risk of exposure as determined by the CP. In addition, collect air samples on at least twenty-five percent of the work crew or a minimum of two employees, whichever is greater, during each work shift.
   c. Submit results of air samples, signed by the CP, within 72 hours after the air samples are taken.
   d. Conduct area air sampling daily, on each shift in which lead-based paint removal operations are performed, in areas immediately adjacent to the lead control area. Sufficient area monitoring shall be conducted to ensure unprotected personnel are not exposed at or above 30 micrograms per cubic meter of air. If 30 micrograms per cubic meter of air is reached or exceeded, stop work, correct the conditions(s) causing the increased levels. Notify the Contracting Officer immediately. Determine if condition(s) require any further change in work methods. Removal work shall resume only after the CP and the Contracting Officer give approval.
   e. Before any work begins, a third party consultant shall collect and analyze baseline soil samples in accordance with methods defined by federal, State, and local standards inside and outside of the physical boundary to assess the degree of dust contamination in the facility prior to lead disturbance or removal.
2. Sampling After Removal: After the visual inspection, conduct soil sampling if bare soil is present during external removal operations and collect soil samples according to the HUD protocol contained in HUD 6780 to determine the lead content of settled dust mg/kg or ppm for soil.

3.5 CLEANING AND DISPOSAL

A. Cleanup: Maintain surfaces of the lead control area free of accumulations of dust and debris. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use pressurized air to clean up the area. At the end of each shift and when the lead operation has been completed, clean the controlled area of visible contamination by vacuuming with a HEPA filtered vacuum cleaner, wet mopping the area and wet wiping the area as indicated by the Lead Compliance Plan. Reclean areas showing dust or debris. After visible dust and debris is removed, wet wipe and HEPA vacuum all surfaces in the controlled area. If adjacent areas become contaminated at any time during the work, clean, visually inspect, and then wipe sample all contaminated areas. The CP shall then certify in writing that the area has been cleaned of lead contamination before clearance testing.
1. Clearance Certification: The CP shall certify in writing that air samples collected outside the lead control area during paint removal operations are less than 30 micrograms per cubic meter of air; the respiratory protection used for the employees was adequate; the work procedures were performed in accordance with 29 CFR 1926.62; and that there were no visible accumulations of material and dust containing lead left in the work site. Do not remove the lead control area or roped off boundary and warning signs prior to the Contracting Officer's acknowledgement of receipt of the CP certification.

For exterior work, soil samples taken at the exterior of the work site shall be used to determine if soil lead levels had increased at a statistically significant level (significant at the 95 percent confidence limit) from the soil lead levels prior to the operation. If soil lead levels either show a statistically significant increase above soil lead levels prior to work or soil lead levels above any applicable federal or state standard for lead in soil, the soil shall be remediated.

B. Disposal

1. All material, whether hazardous or non-hazardous shall be disposed in accordance with all laws and provisions and all federal, State or local regulations. Ensure all waste is properly characterized. The result of each waste characterization (TCLP for RCRA materials) will dictate disposal requirements.

2. Contractor is responsible for segregation of waste. Collect lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing that may produce airborne concentrations of lead particles. Label the containers in accordance with 29 CFR 1926.62 and 40 CFR 261.

3. Dispose of lead-contaminated material classified as hazardous waste at an EPA or State approved hazardous waste treatment, storage, or disposal facility off Government property.

4. Store waste materials in U.S. Department of Transportation (49 CFR 178) approved 55 gallon drums. Properly label each drum to identify the type of waste (49 CFR 172) and the date the drum was filled. For hazardous waste, the collection drum requires marking/labeling in accordance with 40 CFR 262 during the accumulation/collection timeframe. The Contracting Officer or an authorized representative will assign an area for interim storage of waste-containing drums. Do not store hazardous waste drums in interim storage longer than 90 calendar days from the date affixed to each drum.


C. Disposal Documentation: Submit written evidence to demonstrate the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead disposal by the EPA, State or local regulatory agencies. Submit one copy of the completed hazardous waste manifest, signed and dated by the initial transporter in accordance with 40 CFR 262. Contractor shall provide a certificate that the waste was accepted by the disposal facility. Provide turn-in documents or weight tickets for non-hazardous waste disposal.
D. Payment for Hazardous Waste: Payment for disposal of hazardous and non-hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal facility certifying the amount of lead-containing materials or non-hazardous waste delivered is returned and a copy is furnished to the Government.

END OF SECTION
PART 1  GENERAL

1.1  HAZARDOUS MATERIALS


B.  The Owner and BFM Architects Inc. takes no responsibility of the accuracy or the quantities indicated in this report. The report is offered to the Contractor for information purposes only.

PART 2  PRODUCTS

NOT USED

PART 3  EXECUTION

Not Used
<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>HOMOGENEOUS AREA</th>
<th>ASBESTOS CONTENT</th>
<th>SQFT</th>
<th>LNFT</th>
<th>QUANTITY</th>
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PART 1   GENERAL

1.1    SECTION INCLUDES

A. Excavation for building foundations.

B. Excavation for slabs-on-grade, landscaping.

1.2    RELATED SECTIONS

A. Section 01 10 00 – Summary of Work.

B. Section 01 20 00 - Price and Payment Procedures: Unit Prices.

C. Section 01 40 00 - Quality Requirements: Inspection of bearing surfaces.

D. Section 01 50 00 – Construction Facilities and Temporary Controls: Dewatering excavations and water control.

E. Section 02 01 00 - Subsurface Soil Investigation.

F. Section 02 22 30 - Backfilling.

G. Section 02 22 50 - Trenching: Excavation for utility trenches.

1.3    FIELD MEASUREMENTS

A. Verify that survey benchmark and intended elevations for the Work are as indicated.

1.4    CLASSIFICATION OF EXCAVATION

A. All excavation required shall be UNCLASSIFIED, that is, the bid price shall be taken to include and cover all materials required to be excavated whether wet or dry and regardless of the character of the materials.

   1. If rock or unsuitable materials are encountered during excavation of footings, trenching, and paving, it shall be the Contractor’s responsibility, at no additional cost to the Owner, to remove up to 12 inches of the rock and/or unsuitable soils and backfill with compacted structural fill as specified. Any work below the “threshold work” or “take line” shall be handled on a unit cost basis.

   Rock and/or unsuitable soils within 12 inches of the take line shall be removed and backfilled by the Contractor at no additional cost to the Owner.

B. Any soil or excavation, including but not limited to rock, which is not required for the finished work, shall be removed from the site as part of the contract sum.

C. Refer to Section 01 10 00 - Summary for the identification of unit cost for removal of soils and rock beyond the scope of work identified in the contract documents.
PART 2   PRODUCTS

Not Used.

PART 3   EXECUTION

3.1    PREPARATION

A.     Identify required lines, levels, contours, and datum.

B.     Identify known underground, above ground, and aerial utilities. Stake and flag locations.

C.     Notify utility company to remove and relocate utilities.

D.     Protect above and below grade utilities which are to remain.

E.     Protect plant life, lawns, and other features remaining as a portion of final landscaping.

F.     Protect bench marks, existing structures, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.

3.2    EXCAVATION

A.     Underpin adjacent structures which may be damaged by excavation work, including utilities and pipe chases.

B.     Excavate subsoil required to accommodate building foundations, slabs-on-grade paving and site structures, and Construction operations.

C.     Machine slope banks to angle of repose or less, until shored.

D.     Excavation cut not to interfere with normal 30 degree bearing splay of foundation.

E.     Grade top perimeter of excavation to prevent surface water from draining into excavation.

F.     Hand trim excavation. Remove loose matter.

G.     Remove lumped subsoil, boulders, and rock.

H.     Notify Architect/Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

I.     Correct unauthorized excavation at no extra cost to Owner.

J.     Correct areas over-excavated by error.

K.     Stockpile excavated material in area designated on site and remove excess material not being reused, from site at no expense to Owner.
3.3 BLASTING

A. Blasting shall not be allowed.

3.4 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01 40 00.

B. Provide for visual and instrument inspection of bearing surfaces.

C. Bearing surfaces shall be tested by Dynamic Cone Penetrometer per ASTM Special Technical Publication STP-399 - Dynamic Cone for in-situ penetration testing at a minimum rate of one (1) test per ten lineal feet of spread footing and three (3) tests per column footing.

3.4 PROTECTION

A. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.

B. Protect bottom of excavations and soil adjacent to and beneath foundation, from freezing.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES
   A. Building perimeter and site structure backfilling subgrade elevations.
   B. Site filling and backfilling.
   C. Fill under slabs-on-grade and paving.
   D. Consolidation and compaction.
   E. Fill for over-excavation.

1.2 RELATED SECTIONS
   A. Section 01 10 00 - Summary.
   B. Section 01 20 00 - Price and Payment Procedures: Unit Prices.
   C. Section 01 40 00 - Quality Requirements: Testing Fill compaction.
   D. Section 02 01 00 - Subsurface Soil Exploration.
   E. Section 02 22 20 - Excavation.
   F. Section 02 22 50 - Trenching.
   G. Section 02 51 00 – Asphalitic Concrete Paving.
   H. Section 02 52 00 – Portland Cement Concrete Paving.
   I. Section 03 30 00 - Cast-in-Place Concrete: Concrete materials.

1.3 REFERENCES
   C. ANSI/ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.

1.4 SUBMITTALS
   A. Submit under provisions of Section 01 33 00.
   B. Samples: Submit 40 lb. dry density sample of each type of fill to testing laboratory, in air-tight containers at least fourteen (14) days prior to the start of construction.
C. Source of Origin: Submit source of origin for all tested samples.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Type A - Coarse Stone: No. 57 Stone Angular, washed natural stone; free of shale, clay, friable material, sand, debris; graded in accordance with ANSI/ASTM C136 within the following limits:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/2 inch</td>
<td>100</td>
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<tr>
<td>1 inch</td>
<td>95 to 100</td>
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<tr>
<td>1/2 inch</td>
<td>25 to 60</td>
</tr>
<tr>
<td>No. 4</td>
<td>0 to 10</td>
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</table>

B. Type B - Structural Fill: Material having a maximum Dry Density greater than 105 PCF as determined by ASTM D-1557.

C. Type C - Select Fill: MDOT Graded Aggregate Base.

D. Subsoil: Reused, Imported, free of gravel larger than 3 inch size, and debris.

E. Concrete: Structural concrete conforming to Section 03 30 00 with a compressive strength of 4,000 psi.

F. Use of “Recycled, reclaimed, reused or modified” materials shall not be permitted on this project.

2.2 ACCESSORIES

A. Vapor Retardant: 10 mil thick, polyethylene.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify fill materials to be reused are acceptable.

B. Verify foundation perimeter drainage installation has been inspected.

C. Verify underground tanks are anchored to their own foundation to avoid flotation after backfilling.

3.2 PREPARATION

A. Generally, compact subgrade to density requirements for subsequent backfill materials.

B. Cut out soft areas of subgrade not capable of insitu compaction. Backfill with Type B fill and compact to density equal to or greater than requirements for subsequent backfill material.
C. Prior to placement of aggregate base course material at paved areas, compact subsoil to 100 percent of its maximum dry density in accordance with the Geo-Technical Engineer’s recommendations.

3.3 BACKFILLING

A. Backfill areas to contours and elevations with unfrozen materials.
B. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
C. Granular Fill: Place in accordance with the Geotechnical report in Section 02 01 00.
D. Soil Fill: Place and compact material in continuous layers not exceeding 10 inches loose depth if compacted with heavy equipment and 4 inches when compacted by hand operated or light compaction equipment.
E. Maintain optimum moisture content of backfill materials to attain required compaction density.
F. Backfill against supported foundation walls. Do not back-fill against unsupported foundation walls.
G. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.
H. Slope grade away from building minimum 1 unit vertical in 20 units horizontal for a minimum distance of 10 feet, unless noted otherwise.
I. Make grade changes gradual. Blend slope into level areas.
J. Remove surplus backfill materials from site.
K. Leave required fill material stockpile areas completely free of excess fill materials which are to be removed from the site.

3.4 TOLERANCES

A. Top Surface of Backfilling Under Paved Areas: Plus or minus one inch from required elevations.

3.5 FIELD QUALITY CONTROL

A. Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D2487 and with Section 01 40 00.
B. Compaction testing will be performed in accordance with ANSI/ASTM D1557 and with Section 01 40 00 and Section 02 01 00.
C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
D. Frequency of Tests: Provide a minimum of one test per lift for each 500 square feet of backfill or a minimum of four (4) tests per layer of fill or at Owner’s requests.
E. Proof roll compacted fill surfaces under slabs-on-grade pavers and paving.

3.6 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Section 01 50 00.

B. Recompress fills subjected to vehicular traffic.

3.7 SCHEDULE-COMPACTION

A. Interior Slab-On-Grade:
   1. Type A fill, 6 inches thick, compacted with plate compactor.

B. Exterior Side of Foundation Walls, Retaining Walls and Over Granular Filter Material and Foundation Perimeter Drainage:
   1. Type A fill, to subgrade elevation, each lift, compacted to 95 percent.

C. Fill Under Grass Areas:
   1. Subsoil fill, to 6 inches below finish grade, compacted to 90 percent.

D. Fill Under Landscaped Areas:
   1. Subsoil fill, to 12 inches below finish grade, compacted to 90 percent.

E. Fill Under Portland Cement Concrete Paving:
   1. 6 inches of graded aggregate base course compacted to 100% of Standard Proctor.
      a. Approved subgrade (CBR-3, minimum).

F. Fill under Structure and Pavements, below aggregate base course and any fill required to Correct Over-excavation:
   1. Type B (Structural fill) fill, flush to required elevation, compacted to 100 percent at structure and 98% at common areas.

G. Sidewalks, concrete walkways, trenches and stoops:
   1. 4 inches of Type C (Select fill) fill, to 4 inches below finish paving elevation, compacted to 98 percent.

H. Trench Work (Under landscaped areas)
   1. Type C fill to 12 inches below finish grade, compacted to 90 percent.

I. Trench Work (under Asphalt Concrete Paving)
   1. 10 inches of Type C fill to 5 to 2 inches below finish paving elevation as scheduled, compacted to 100 percent.

J. Manhole, inlet, underground structure bedding.
   1. Type C fill 12" deep compacted at 100 percent.

K. Concrete Dumpster Pads and Loading Dock Drive
   1. 8 inches of Graded Aggregate Base compacted to 100 percent.

L. Stormwater Management Structure
   1. Materials/Compaction in accordance with the Maryland 378 Specifications for ponds.

END OF SECTION
PART 1  GENERAL

1.1  SECTION INCLUDES

   A. Excavate trenches for utilities as indicated on the plans from building to municipal utilities.
   B. Compacted bedding under fill over utilities to subgrade elevations.
   C. Backfilling and compaction requirements.
   D. Compliance with utility specifications.

1.2  RELATED SECTIONS

   A. Section 01 20 00 - Price and Payment Procedures: Unit Prices.
   B. Section 01 40 00 - Quality Requirements: Testing fill compaction.
   C. Section 01 50 00 – Construction Facilities and Temporary Controls.
   D. Section 02 01 00 - Subsurface Soil Investigation.
   E. Section 02 22 20 - Excavation: General building excavation.
   F. Section 02 22 30 - Backfilling: General backfilling.
   G. Section 02 58 80 - Underground Ducts and Utility Structures.
   H. Section 03 30 00 - Cast-in-Place Concrete: Concrete materials.

1.3  REFERENCES

   B. ANSI/ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.

1.4  SUBMITTALS

   A. Submit under provision of Section 01 33 00.
   B. Samples: Submit 40-50 lb sample of each type of fill to testing laboratory, in air-tight containers at least fourteen (14) days prior to the start of construction.

1.5  FIELD MEASUREMENTS

   A. Verify that survey benchmark and intended elevations for the Work are as shown on Drawings.
1.6 PROTECTION

A. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation.

B. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.

C. Notify Architect/Engineer of unexpected subsurface conditions and discontinue work in affected area until notification to resume work.

D. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.

E. Grade excavation top perimeter to prevent surface water run-off into excavation.

PART 2 PRODUCTS

2.1 CLASSIFICATION OF EXCAVATION

A. All excavation required shall be UNCLASSIFIED as defined in Section 02 22 20.

2.2 FILL MATERIALS

A. Types A, B, C, Subsoil and Concrete materials as specified in Section 02 22 30.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify fill materials to be reused, is acceptable.

3.2 PREPARATION

A. Identify required lines, levels, contours and datum.

B. Maintain and protect existing utilities remaining, which pass through work area.

C. Protect plant life, lawns, and other features remaining as a portion of final landscaping.

D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.

E. Protect above and below grade utilities which are to remain.

F. Cut out soft areas of subgrade not capable of insitu compaction in their natural and present state. Backfill with Type C fill as specified in Section 02 22 30 and compact to density equal to or greater than requirements for subsequent backfill material.

3.3 EXCAVATION

A. Excavate subsoil required for utility piping to municipal utilities requirements or as detailed.
B. Cut trenches sufficiently wide to enable installation of utilities and allow inspection. Minimum clearance shall be 6 inches on each side of pipe or conduit.

C. Excavation shall not interfere with normal 30 degree bearing splay of foundations.

D. Hand trim excavation. Hand trim for bell and spigot pipe joints, if required. Remove loose matter.

E. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd, measured by volume.

F. Correct unauthorized excavation at no cost to Owner.

G. Correct areas over-excavated by error in accordance with Section 02 22 20 at no additional cost to the Owner.

H. Stockpile excavated material in area designated on site and remove excess material not being re-used from site at no expense to the Owner.

3.4 BEDDING
A. Support pipe or conduit during placement and compaction of bedding fill.

3.5 BACKFILLING
A. Backfill trenches to contours and elevations with unfrozen materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

C. Bedding Fill: Place and compact materials in continuous layers not exceeding 4 inches loose lifts when compacted by hand-operated or light compaction equipment.

D. Approved Subsoil Fill: Place and compact material in continuous layers not exceeding 4 inches loose lifts when compacted by hand-operated or light compaction equipment.

E. Employ a placement method that does not disturb or damage foundation perimeter drainage or conduit in trench.

F. Maintain optimum moisture content of backfill materials to attain required compaction density.

G. Remove surplus backfill materials from site at no additional cost to Owner.

H. Leave fill material stockpile areas completely free of excess fill materials.

3.6 TOLERANCES
A. Top Surface of Backfilling: Under Paved Areas Plus or minus one inch from required elevations.

B. Top Surface of General Backfilling: Plus or minus one inch from required elevations.

3.7 FIELD QUALITY CONTROL
A. Field inspection and testing will be performed under provisions of Section 01 40 00.
B. Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D2487 and with Section 01 40 00.

C. Compaction testing will be performed in accordance with ANSI/ASTM D1556 and ANSI/ASTM D1557 and Section 01 40 00.

D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

E. Frequency of Tests: Minimum one (1) test every 25 lineal feet of trench, each layer, or as may be determined by Owner.

3.8 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Section 01 73 00.

B. Recompact fills subjected to vehicular traffic.

3.9 SCHEDULE

A. Water, Gas, and Sanitary Piping:
   1. Bedding Fill: Type B (Structural Fill) or as required by the local authority’s Construction Specifications and all addenda, compacted to 95 percent. Minimum depth 6 inches above top of pipe.
   2. Cover with Type B (Structural Fill), in 8 inch lifts, compacted to 100 percent.

B. Power Ducts
   1. Bedding fill of Type C (Select Fill), in 8 inch lifts, compacted to 100 percent.
   2. Remaining fill of Type C (Select Fill), to subgrade elevation, compacted to 100 percent.

C. Storm Drain
   1. Wherever rock is encountered, it shall be removed and replaced with a minimum 8 in. (200 mm) of select backfill to provide a constant cushion under the pipe or bell. When unsuitable foundation material is encountered, it shall be removed and replaced with selected backfill for the full width of the trench, as directed by the Engineer.

D. General Utility Information
   1. All underground utility trenches shall be backfilled as specified and shall have a warning tape at depth as detailed or as by the Owner.
   2. All plastic underground utilities shall in addition have a detection wire installed at trench depth indicated or as directed by the Owner.

END OF SECTION
PART 1 - GENERAL

1.1 REQUIREMENTS OF REGULATORY AGENCIES

A. Erosion and Sediment Control Plan:
   1. Prior to initiating earthmoving activities, implement the approved Soil Erosion and Sediment Control Plan shown on the Contract Drawings in accordance with rules and regulations adopted by the Maryland Department of the Environment, Water Management Administration.

B. Fines and related costs resulting from failure to provide adequate protection against soil erosion and sediment control are the obligation of the Contractor.
   1. Silt, sediment, and mud leaving the site will be construed as damage to neighboring property and evidence of negligence on the part of the Contractor.
   2. Damages to neighboring property shall be rectified to the satisfaction of the neighbor and/or restitution shall be paid by the Contractor.

C. Conduct work in compliance with rules, regulations and requirements of the Maryland Department of the Environment, Water Management Administration and the approved contract drawings. Erosion and sediment control measures employed will be subject to approval and inspection by the Water Management Administration Inspector.

1.2 SUBMITTALS

A. Samples: Submit samples of materials being used when requested by the Engineer including names, sources, and descriptions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials for erosion and sediment control work are as described on the Contract Drawings.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Conduct work in compliance with the approved erosion and sediment control plan.

B. Maintain all sediment control measures in optimum working condition throughout duration of project

C. Contractor to maintain a log book of inspections, repairs, etc. to the standards required in the NPDES permit for the site. This log book must be available at the site at all times during construction for the review and use by the owner, architect, engineer and inspectors.

END OF SECTION
PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following for termite control:
   1. Soil Treatment

1.3 DEFINITIONS

A. EPA: Environmental Protection Agency.

B. PCO: Pest Control Operator.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

B. Product Data: Treatments and application instructions, including EPA-Registered Label.

C. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.

D. Qualifications Data: For firms and persons specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner’s record information, including the following as applicable:
   1. Date and time of application
   2. Moisture content of soil before application
   3. Brand name and manufacturer of termiticide
   4. Quantity of undiluted termiticide used
   5. Dilutions, methods, volumes, and rates of application used
   6. Areas of application
   7. Water source for application

F. Warranties: Special warranties specified in this Section

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A PCO who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that indicated for this Project and whose work has a record of successful in-service performance.
1.6 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements of authorities have jurisdiction.

1.7 COORDINATION

A. Coordinate soil treatment application with excavating, filling and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

1.8 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

C. Warranty Period: Three years from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

A. Continuing Service: Provide a proposal for continuing service, including monitoring, inspection, and retreatment for occurrences of termite activity, from applicator to Owner in the form of a standard yearly (or other period) continuing service agreement, starting on the date of Substantial Completion. State services, obligations conditions, and terms for agreement period and for future renewal options.

PART 2 PRODUCTS

2.1 SOIL TREATMENT

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsifiable, concentrated formulation that dilutes with water or foaming agent and formulated to prevent termite infestation. Use only soil treatment solutions that are not harmful to plants.

Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product’s EPA-Registered Label.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:

1. Premise
2. Termidor
3. Owner approved equal.
PART 3   EXECUTION

3.1  EXAMINATION

A. Examine substrates, areas and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control. Proceed with application only after unsatisfactory conditions have been corrected.

3.2  PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer’s written instructions for preparing substrate. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.

C. Fit filling hose connected to water source at the site with a backflow preventer complying with requirements of authorities having jurisdiction.

3.3  APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer’s EPA-Registered Label for products.

3.4  APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer’s EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.

2. Foundations: Adjacent soil including soil along entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers, piers, and chimney bases; and along entire outside perimeter, form grade to bottom of footing. Avoid soil washout around footings.

3. Crawlspaces: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.


5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION
PART 1  GENERAL

1.1  SECTION INCLUDES

A.  Asphaltic concrete paving and surface sealer; wearing binder or base course.
B.  Aggregate base course.
C.  Pavement markings.

1.2  RELATED SECTIONS

A.  Section 01 40 00 - Quality Requirements.
B.  Section 02 01 00 - Subsurface Soil Exploration.
C.  Section 02 22 30 - Backfilling: Aggregate base.
D.  Section 02 52 00 - Portland Cement Concrete Paving.

1.3  REFERENCES

E.  ASTM D946 - Penetration-Graded Asphalt Cement for Use in Pavement Construction.

1.4  PERFORMANCE REQUIREMENTS

A.  Paving: Designed for buses, light duty commercial vehicles, and passenger cars.

1.5  QUALITY ASSURANCE

A.  Perform Work in accordance with AI Manual MS-8 and State of Maryland Highways standards.
C.  Obtain materials from same source throughout.
D.  Maintain one copy of each document on site.
1.6 SUBMITTALS

A. Submit certification in accordance with Section 01 33 00 that materials and products meet or exceed specified requirements.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable code for paving work on public property.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not place surface asphalt until base surface temperature is 40 degrees F and rising, and at least 32 degrees F and rising for placing base asphalt. Do not place pavement if surface is wet or frozen.

PART 2 PRODUCTS

2.1 MATERIALS

A. Asphalt Cement: In accordance with State of Maryland Highways Standards. The price asphalt will be determined by comparing the Asphalt Index price from the month of bid to the Asphalt Index Price of the month of installation. The adjustment of price can go up or down depending on the Asphalt Index Price.

B. Aggregate for Binder Course Mix: In accordance with State of Maryland Highways standards.

C. Aggregate for Wearing Course Mix: In accordance with State of Maryland Highways standards.

D. Fine Aggregate: In accordance with State of Maryland Highways standards.

E. Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.

2.2 ACCESSORIES

A. Tack Coat: Homogeneous, medium curing, liquid asphalt in accordance with State of Maryland Highways standards.

B. Joint Sealer: Hot applied joint filler meeting the requirements of AASHTO and M173.
   1. Apply in accordance with manufacturer's recommended pouring temperature with a minimum thickness of 1/2 inch.

2.3 ASPHALT PAVING MIX

A. Use dry material to avoid foaming. Mix uniformly.

B. Base Course: Superpave 25.0 mm for base PG-64-22 in accordance with all State of Maryland Highways standards.

C. Base Course: Superpave 19.0 mm for base PG-64-22 in accordance with all State of Maryland Highways standards.
D. Surface Course: Superpave 12.5 mm for surface PG-64-22 in accordance with all State of Maryland Highways standards.

2.4 PAVEMENT MARKINGS

A. Pavement Marking: Alkyd Resin Type, 75% solids by weight and 54% solids by volume equal to PPG's eleven (11) series. Federal Spec. (GSA-FES) TT-P-115F Type I. Colors shall be provided in white, yellow and blue.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify base conditions under provisions of Section 01 40 00.
B. Verify that compacted granular base is dry and ready to support paving and imposed loads.
C. Verify gradients and elevations of base are correct.

3.2 SUBBASE

A. Section 02 22 30 - Backfilling: Type C forms the base construction for work of this Section.

3.3 PREPARATION - TACK COAT

A. Apply tack coat in accordance with AMS-19 and State of Maryland Highways Standards.
B. Apply tack coat to contact surfaces of curbs, and gutters.
C. Coat surfaces of manhole catch basin and frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.4 PLACING ASPHALT PAVEMENT - SINGLE COURSE

A. Install Work in accordance with State of Maryland Highways Standards.
B. Place asphalt within 24 hours of applying tack coat.
C. Maximum compacted depth for a single course shall not exceed 4 inches.
D. Install gutter drainage grates and frames and manhole frames in correct position and elevation.
E. Compact pavement by rolling. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
F. Develop rolling with consecutive passes to achieve even and smooth finish, without roller marks.
3.5  PLACING ASPHALT PAVEMENT - DOUBLE COURSE
A. Install work in accordance with State of Maryland Highway Standards.
B. Place asphalt within 24 hours of applying tack coat.
C. For course layers greater than 4 inches, place in multiple lifts with no single lift greater than 3 inches of compacted depth.
D. Place wearing course within 48 hours of placing and compacting base binder course.
E. Place wearing course(s) to 1 1/2 inch to 2 inch compacted thickness.
F. Install gutter drainage grilles and frames and manhole frames in correct position and elevation.
G. Compact pavement by rolling. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
H. Develop rolling with consecutive passes to achieve even and smooth finish, without roller marks.
I. All utility appurtenances, such as, but not limited to, manhole covers, cleanouts, valves, etc. shall be flush with the finished asphalt surface.

3.6  JOINT SEALERS
A. Apply joint sealer in accordance with manufacturer's recommended pouring temperature at a minimum thickness of 1/2 inch.

3.7  TOLERANCES
A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
B. Scheduled Compacted Thickness: Within 1/4 inch.
C. Variation from True Elevation: Within 1/2 inch.

3.8  PAVEMENT MARKINGS
A. Lines shall be a minimum 4 inches wide applied with one coat of specified product. Colors shall be as selected by the Architect in blue, white and yellow.

3.9  PROTECTION
A. Immediately after placement, protect pavement from mechanical injury for seven (7) days.

END OF SECTION
PART 1    GENERAL

1.1    SECTION INCLUDES

A.   Pipe and fittings for site water line including domestic water line and fire water line.

B.   Valves and fire hydrants.

1.2    PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A.   Division 22 Plumbing:  Supply of connection devices to building water main piping for placement by this Section.

1.3    RELATED SECTIONS

A.   Section 02 22 20 – Excavation.

B.   Section 02 22 30 - Backfilling.

C.   Section 02 22 50 - Trenching.

1.4    REFERENCES


D.   ANSI/AWWA C151 – Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or other liquids.

E.   ANSI/AWWA C500 – Gate Valves, 3 through 48 in NPS, for Water and Sewage Systems.


H.   ANSI/AWWA C509 – Resilient Seated Gate Valves 3 in through 12 in NPS, for Water and Sewage Systems.


J.   ASTM D2922 – Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

1.5 SUBMITTALS
A. Submit under provisions of Section 01 33 00.
B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.6 PROJECT RECORD DOCUMENTS
A. Submit under provisions of Section 01 73 00.
B. Accurately record actual locations of piping mains, valves, connections, and invert elevations.
C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 QUALITY ASSURANCE
A. Perform Work in accordance with City of Hagerstown’s Water and Wastewater Standards and Specifications.
B. Valves: Manufacturer's name and pressure rating marked on valve body.
C. Perform all work in accordance with Code Authority standards.

1.8 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.
B. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS
2.1 MANUFACTURERS - WATER PIPE
A. All pipes, fittings, valves, hydrants and other related materials used in the additions to the water distribution system must comply fully with the specifications and requirements of the City of Hagerstown. All water line installations shall be new and unused cast iron and/or ductile iron pipe fittings and valves of the size, type and character outlined in the following specifications.

2.2 PIPE
A. Ductile Iron Pipe: ANSI/AWWA C151:
   1. Fittings: Ductile iron, standard thickness.

B. Copper Tubing: ASTM B88, Type K, annealed:
   2. Joints: Compression connection or ANSI/AWS A5.8, BCuP silver braze.

2.3 GATE VALVES - 3 Inches and Over

A. Manufacturers:
   1. American Darling Valve and Manufacturing Co.
   2. A.P. Smith Co.

B. ANSI/AWWA C500, Cast Iron body, bronze trim, non-rising stem with square nut, single wedge, mechanical joint ends, control rod, and extension box.

2.4 HYDRANT

A. Hydrant: Type as required by Code Authority.

2.5 BEDDING AND BACKFILL MATERIALS

A. Bedding: Not required for cast or ductile iron pipe unless rock is encountered, then Type E (Fill) to trench subgrade in 4” to 8” lifts.

2.6 ACCESSORIES

A. Concrete for Thrust Blocks: As detailed or in accordance with governing authority.

B. Backflow Preventer: as detailed or in accordance with governing authority.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions.

B. Verify that building service connection and municipal utility water main size, location and invert are as indicated.

3.2 PREPARATION

A. Ream pipe and tube ends and remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 02 22 50 for work of this Section.
Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth, compact to 95 percent.

C. Backfill around sides and to top of pipe with fill, tamped in place and compacted to 95 percent.

D. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

A. Maintain separation of water main from sewer piping in accordance with the City of Hagerstown’s requirements.

3.5 INSTALLATION - VALVES AND HYDRANTS

A. Set valves on solid bearing.

B. Center and plumb valve box over valve. Set box cover flush with finished grade.

C. Set hydrants plumb and locate pumper nozzle perpendicular to roadway.

D. Set hydrants to grade, with nozzles at least 20 inches above ground.

E. Locate control valve 4 inches away from hydrant.

F. Provide a drainage pit 36 inches square by 24 inches deep filled with 2 inches mm washed gravel. Encase elbow of hydrant in gravel to 150 mm above drain opening. Do not connect drain opening to sewer.

G. Paint hydrants in accordance with the City of Hagerstown’s requirements.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with the City of Hagerstown’s Standard Construction Specifications.

3.7 SERVICE CONNECTIONS

A. Provide water service as required by the City of Hagerstown’s Standards.

3.8 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 40 00.

B. Compaction testing will be performed in accordance with ASTM 1557.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

D. Frequency of Tests:
1. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have sufficiently hardened. Fill pipeline 24 hours prior to testing and apply test pressure to stabilize system. Use only potable water.

2. Hydrostatic Tests: Test at 200 psi for 2 hours, or according to applicable City of Hagerstown requirements.

3. Contractor is responsible for providing all water for line test and disinfecting.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete sidewalks and exterior stair steps, fence post foundations, integral curbs, gutters, parking areas and exterior pads as detailed in the plans.

B. Aggregate base course.

1.02 RELATED SECTIONS

A. Section 01 40 00 - Quality Requirements: Testing of concrete mixes as specified in conjunction with Section 03 30 00.

B. Section 02 01 00 - Subsurface Soils Investigation.

C. Section 02 22 30 - Backfilling: Aggregate base.

D. Section 02 51 00 - Asphalitic Concrete Paving: Pavement markings.

E. Section 07 90 00 - Sealants: Sealant for joints.

1.03 REFERENCES

A. ACI 301 - Specifications for Structural Concrete for Buildings.

B. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

C. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

D. ANSI/ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.

E. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.

F. ANSI/ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

G. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.

H. ASTM C33 - Concrete Aggregates.

I. ASTM C94 - Ready Mix Concrete.

J. ASTM C150 - Portland Cement

K. ASTM C260 - Air-Entraining Admixtures for Concrete.

L. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
M. ASTM C494 - Chemical Admixtures for Concrete.
N. FS TT-C-800 - Curing Compound, Concrete, for New and Existing Surfaces.

1.04 PERFORMANCE REQUIREMENTS
A. Area Paving: At dumpster and loading docks, design for heavy duty commercial vehicles.

1.05 SUBMITTALS
A. Submit under provisions of Section 01 33 00.
B. Product Data: Provide data on joint filler admixtures curing compounds.

1.06 QUALITY ASSURANCE
A. Perform work in accordance with requirements of Sections 03 10 00, 03 20 00 and 03 30 00 and the Maryland State Highway Administration, whichever is more stringent.
B. Obtain cementitious materials from same source throughout.

1.07 REGULATORY REQUIREMENTS
A. Conform to applicable standards for paving work on public property and Maryland State Highway requirements.

1.08 ENVIRONMENTAL REQUIREMENTS
A. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.01 FORM MATERIALS
A. Form Materials: As specified in Section 03 10 00.
B. Joint Filler: Flexible foam expansion joint filler complying with ASTM D1752, Sections 5.1 through 5.4; 2 inch thick, equal to Ceramor by W. R. Meadows with water absorption of 0.24% of volume as tested in accordance with ASTM D545.

2.02 REINFORCEMENT
A. Reinforcing Steel and Wire Fabric: Type specified in Section 03 20 00.
B. Dowels: ASTM A615; 60 ksi yield grade, plain steel, unfinished finish.

2.03 CONCRETE MATERIALS
A. Concrete Materials: As specified in Section 03 30 00.
C. Water: Potable, not detrimental to concrete.
E. Chemical Admixture: ASTM C494, Type A - Water Reducing

2.04 ACCESSORIES
A. Curing Compound: ASTM C309, Type 1; clear manufactured by Sonneborn.
B. Liquid Surface Sealer: manufactured by Sonneborn.
C. Air Entrainment: ASTM C260; DARAVAIR 1000 or equal manufactured by W. R. Grace.

2.05 CONCRETE MIX - BY PERFORMANCE CRITERIA
A. Mix and deliver concrete in accordance with ASTM C94, Alternative No. 2.
B. Select proportions for normal weight concrete in accordance with ACI 301 Method 2.
C. Provide concrete to the following criteria for flat work, slabs and walls:
   1. Compressive Strength: 2,200 psi @ 7 days.
   2. Compressive Strength: 4,000 psi @ 28 days.
D. Use accelerating admixtures in cold weather only when approved by Architect/Engineer. Use of admixtures will not relax cold weather placement requirements.
E. Calcium chloride will not be permitted.
F. Use set retarding admixtures during hot weather only when approved by Architect/Engineer.
G. Add air entraining agent to normal weight concrete mix for work exposed to exterior at a rate of 5-7 percent air content.
H. Concrete for foundations shall conform to MSHA Mix No. 2 or better.

2.06 SOURCE QUALITY CONTROL
A. Provide mix design under provisions of Section 01 40 00.
B. Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement of work.
C. Tests on cement and aggregates will be performed to ensure conformance with specified requirements.
D. Test samples in accordance with ACI 301 and as specified in section 03 30 00.

PART 3 EXECUTION

3.01 EXAMINATION
WCPS: Boonsboro High School       PORTLAND CEMENT       02 52 00 - 3
Auditorium & Stage Renovations     CONCRETE PAVING
A. Verify base conditions under provisions of Section 01 40 00.

B. Verify compacted granular base is acceptable and ready to support paving and imposed loads.

C. Verify gradients and elevations of base are correct.

3.02 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Coat surfaces of manhole catch basin and frames with oil to prevent bond with concrete pavement.

C. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

3.03 FORMING

A. Place and secure forms to correct location, dimension, and profile.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.04 REINFORCEMENT

A. Place reinforcement as indicated.

B. Interrupt reinforcement at expansion joints.

C. Place reinforcement to achieve pavement and curb alignment as detailed.

D. Provide doweled joints 12 inch on center at interruptions of concrete with one end of dowel set in capped sleeve to allow longitudinal movement.

3.05 PLACING CONCRETE

A. Place concrete in accordance with ACI 301 as specified in Section 03 30 00.

B. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.

C. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

D. Place concrete to pattern indicated.

3.06 JOINTS

A. Place expansion joints at 20 foot intervals. Align curb, gutter, and sidewalk joints.

B. Place joint filler between paving components and building or other appurtenances. Recess top of filler 3 inch for sealant placement by Section 07 90 00.
C. Provide scored joints at intervals indicated on drawings at 1/2 inch depth.

3.07 FINISHING
A. Area Paving: Wood float with light broom.
B. Sidewalk Paving: Light broom, radius to 1/8 inch radius, and trowel joint edges.
C. Curbs and Gutters: Light broom.
D. Inclined Wheelchair Ramps: Herringbone V-joint
E. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.08 FIELD QUALITY CONTROL
A. Field inspection and testing will be performed under provisions of Section 01 40 00.
B. Three concrete test cylinders will be taken for every 50 or less cu. yds. of concrete of each class placed each day. Cylinders shall be tested on 7 and 28 day intervals, the third cylinder shall be tested if a failure should occur and be utilized as a comparison.
C. One additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.
D. One slump test and air content test will be taken for each set of test cylinders taken.
E. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.
F. Tolerance at top of curb shall not vary more than 3 inch total dimension variance within a ten (10) foot straight edge. Vertically, the total dimension variance shall not be greater than 1/8 inch in a six (6) inch curb face. Total dimension variance between spot elevations in the same plain shall not be greater than 2 inch.

3.09 PROTECTION
A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

3.10 SCHEDULE
A. Dumpster Pad
   Base: 8" MDOT Graded Aggregate Base Aggregate
   Vapor Barrier: Polyethylene 10 mil
   Concrete: 8" concrete 4,000 psi with welded fabric WWF 6x6 B W2.9 X W2.9
   Where slabs tie together - No. 5 rebar at 12" o/c - 18 inches long.
B. All other areas: 3,500 psi and as detailed.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sanitary sewerage drainage piping, fittings, accessories and bedding.
B. Connection of building sanitary drainage system to municipal sewers.
C. Cleanout access.

1.2 RELATED SECTIONS

A. Section 02 22 20 – Excavation.
B. Section 02 22 30 – Backfilling.
C. Section 02 22 50 - Trenching
B. Section 02 63 00 - Storm Drainage

1.3 REFERENCES

C. ANSI/ASTM D1556 - Test Methods for Density of Soil in Place by the Sand-Cone Method.
D. ANSI/ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
E. ANSI/ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
F. ASTM A746 - Ductile Iron Gravity Sewer Pipe.
H. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
I. ASTM C478 - Precast Reinforced Concrete Manhole Sections.
J. ASTM C923 - Resilient Connectors between Reinforced Concrete Manhole Structures and Pipes.
K. ANSI/ASTM C55 - Concrete Building Brick.
1.4 DEFINITIONS
A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.5 SUBMITTALS
A. Submit under provisions of Section 01 33 00.
B. Shop Drawings: Indicate manholes locations, elevations, piping, and sizes and elevations of penetrations.
C. Product Data: Provide data indicating pipe, pipe accessories, manhole covers, component construction, features, configuration, and dimensions.
D. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
E. Manufacturer's Certificate: Certify that products meet or exceed requirements.

1.6 PROJECT RECORD DOCUMENTS
A. Submit documents under provisions of Section 01 73 00.
B. Record location of pipe runs, connections, cleanouts, and invert elevations.
C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 REGULATORY REQUIREMENTS
A. Conform to applicable code for materials and installation of the Work in accordance with the Standard Construction Specifications of the jurisdiction having authority.

1.8 FIELD MEASUREMENTS
A. Verify that field measurements and elevations are as indicated.

1.9 COORDINATION
A. Coordinate the Work with termination of sanitary sewer connection outside building, connection to municipal sewer utility service, and trenching.

PART 2 PRODUCTS

2.1 SEWER PIPE MATERIALS
A. All pipes, fittings and other related materials used on the construction of additions to the sanitary sewer system must comply fully with the specifications and requirements of the jurisdiction having authority.
B. Plastic Pipe: ASTM D3034, S.D.R. 35, Poly (Vinyl Chloride) material; inside nominal diameter of 4, 6 and 8 inches, bell and spigot style solvent sealed joint end.
C. Sewer Force Main shall be PVC AWWA – C900. PVC pressure wastewater pipe and fittings shall be produced from resins meeting ASTM D-1784.

D. Manhole Sections: Reinforced cast-in-place concrete as specified in MSHA Section 305.

E. Concrete Brick Units: MSHA Section 903.02.

F. Mortar for Grout: As specified in MSHA Section 902.11.

G. Reinforcement: MSHA Section 908.

H. Mortar for Masonry: MSHA Section 903.06.

2.2 PIPE ACCESSORIES

A. Gaskets: ASTM F4777, elastomeric seal.

B. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Sanitary Sewer Service" in large letters.

2.3 BEDDING AND BACKFILL MATERIALS

A. Bedding: Four inches (4") of MSHA gradation No. 4 stone up to spring line, see Sections 02 22 30.

B. Backfill: Fill Type C – Graded Aggregate Base as specified in Section 02 22 30 and 02 22 50.

2.2 COMPONENTS

A. Lid and Frame: Grates and lids 12” and larger shall be designed to withstand H-20 loading. Grates and lids smaller than 12” shall be designed to withstand H10 loading.


2.3 CONFIGURATION

A. Shaft Construction: Concentric with eccentric cone top section; lipped male/female dry joints; sleeve to receive pipe sections.

B. Shape: Cylindrical.

C. Clear Inside Dimensions: 48 inch diameter, unless otherwise noted.

D. Design Depth: As indicated.

E. Clear Lid Opening: As indicated.

F. Pipe Entry: Provide openings as required.

G. Steps: 10 inches wide, 12 inches on center vertically, set into manhole wall.
PART 3  EXECUTION

3.1  EXAMINATION

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

B. Verify items provided by other sections of Work are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into Work.

D. Verify excavation for manholes is correct.

3.2  PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.

B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

C. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections

3.3  BEDDING

A. Excavate pipe trench in accordance with Section 02 22 50 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth, compact to 95 percent.

C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4  INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with ASTM C12 and manufacturer's instructions. Seal joints watertight.

B. Lay pipe to slope gradients noted on drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

C. Install bedding at sides and over top of pipe to minimum compacted thickness of 12 inches; in compacted layers, which shall not exceed 6 inches each. See section 02 22 30 for compaction requirements.

D. Refer to Section 02 22 50 for trenching requirements. Do not displace or damage pipe when compacting.

E. Connect to building sanitary sewer outlet and municipal sewer system.

F. Install trace wire continuous over top of pipe. Buried 6 inches below finish grade, above pipe line; coordinate with Section 02 22 50.
3.5 PLACING MANHOLE SECTIONS
   A. Place base pad, trowel top surface level.
   B. (Precast Manhole) Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.
   C. (Cast-in-Place Manhole) Form and place manhole cylinder plumb and level, to correct dimensions and elevations. As work progresses, built-in fabricated metal items.
   D. Cut and fit for pipe sleeves.
   E. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.
   F. Set cover frames and covers level without tipping, to correct elevations.
   G. Coordinate with other sections of work to provide correct size, shape, and location.

3.6 INSTALLATION - CLEANOUTS
   A. Form bottom of excavation clean and smooth to correct elevation.
   B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.
   C. Establish elevations and pipe inverts for inlets and outlets as indicated.
   D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.7 FIELD QUALITY CONTROL
   A. Field inspection and testing will be performed under provisions of Section 01 40 00.
   B. Request inspection prior to and immediately after placing bedding.
   D. Compaction testing will be performed in accordance with ASTM 1557.
   E. Contractor is responsible for low pressure air tests to verify no leakage.
   F. Contractor is to provide recorded video of all installed underground sanitary sewer utility lines immediately after backfilling for review and acceptance by the Owner and code officials. If sanitary lines are not draining properly, this Contractor is responsible for all work including excavation and backfill necessary to correct sanitary lines.

   Contractor shall provide temporary water supply necessary to run water through the lines no less than 24 hours before each recording.

   Contractor shall properly drain and dispose of the water.

   G. Contractor is responsible for documenting the as-built clean-out connections, invert elevations, and installed grades.
H. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

I. Frequency of Tests: Perform testing of completed piping in accordance with the Jurisdiction having authority or at the Owner's request.

3.7 PROTECTION

A. Protect finished installation under provisions of Section 01 73 00.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION
PART 1  GENERAL

1.1  RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 1 Specification Sections, apply to this section.

1.2  SUMMARY

A. Section Includes:
   1. Utility coordination.
   2. Marker tape.
   4. Direct Buried conduit.
   5. Directional bored conduit.
   6. Handholes.

B. Related Sections:
   1. Section 02 22 50 – Trenching.
   2. Section 26 05 19 – Low Voltage Electrical Power Conductors & Cables: grounding conductors and attachments.
   3. Section 26 05 26 – Grounding and Bonding for Electrical Systems for ground rods, grounding and bonding requirements of utility structure components.
   4. Section 26 22 13 - Dry Type Distribution Transformers.

1.3  SUBMITTALS

A. Submittal Requirements of this section in accordance with Section 01 33 00.
   1. Utility Marker Tape
   2. Ductbank spacers
   3. Handholes, covers & accessories

B. Product data, including construction, materials, ratings, etc.

C. Submit the following for each handhole:
   1. Manufacturer/cat. number.
   2. Manufacturer’s dimensional drawing(s).
   3. Indicate open or closed bottom.
   4. Type, rating, color and labels of covers.
   5. Type and material of lid hardware.
   6. Additional information to show compliance with specifications or drawings.

D. Product Test Reports: Certified copies of handhole or manhole manufacturer's design, factory tests, required by the referenced standards.

1.4  QUALITY ASSURANCE

A. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
   1. The Terms “Listed and Labeled”: As defined in the National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A “Nationally Recognized Testing Laboratory” (NRTL) as defined in OSHA Regulation 1910.7.

B. Manufacturer/Vendor Requirements:
   1. Coordinate the components of the system and their arrangements electrically and mechanically.

C. Installation Quality: In accordance with recognized trade organizations and standards.
   1. ANSI (American National Standards Institute)
   2. NEC (National Electrical Code)
   3. NECA “Standards of Installation”
   4. NEMA (National Electrical Manufacturers Association)

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading:
   1. Provide all transportation of equipment to site.
   2. Provide for rigging needed for unloading, and setting large handholes into final position.

B. Storage and Protection:
   1. Protect all utility structures from damage prior to installation.

1.6 SEQUENCING

A. General Sequencing:
   1. Coordinate with other underground utilities and structures such that deeper equipment is installed first, where possible.
   2. Provide stakeout of all underground and in-ground equipment to identify conflicts prior to trenching or excavation.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:
   1. Composite Handholes:
      a. Strongwell Quazite
      b. Fiberlyte

2.2 BURIED UTILITY MARKER TAPE

A. Non-biodegradable 3" wide plastic marker tape 12" below grade above every ductbank and buried conduit. A system description (i.e. "ELECTRIC") shall appear continuously along its length. Tape shall meet ASTM D1712, “Standard Practice for Resistance of Plastics to Sulfide Staining” tests for color fastness. Tape shall contain a metallic core, which can be detected after burial in ground.
   1. Electric - Red
   2. Telephone - Orange
2.3 UNDERGROUND DUCTBANKS

A. General:
   1. Underground ductbanks shall be arrangements of single bore, PVC plastic conduits, concrete encased with (where indicated) steel rebar.

B. Materials:
   1. Conduit and Fittings:
      a. UL Listed, Type II, heavy-wall schedule 40 PVC.
      b. Conduit and fittings shall be as specified in Division 16 Section - Raceways and Boxes.
   2. Concrete:
      a. 3,000 psi test at 28 days.
      b. Pea gravel aggregate for void-free duct penetration.
   3. Reinforcing:
      a. Deformed conforming to ASTM A615, “Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement,” Grade 40 or Grade 60, minimum ½.”
      b. Coated rebar where exposed to earth, such as on ductbank stubouts.
   4. Spacers:
      a. Precast plastic, base and intermediate.
   5. Joint Sealant:
      a. Watertight as per by conduit manufacturer.
   6. Cable Sealing Bushings:
      a. OZ type CSB, with PVC coated discs, or equal.
   7. Thru-wall and Floor Seals:
      a. OZ type "FSK" or "WSK", or equal.

2.4 DIRECT BURIED CONDUIT

A. For direct buried 600 volt electrical circuits:
   1. PVC schedule 40 or PVC coated galvanized steel conduit, as indicated.
   2. Conduit as specified in Division 16 Section “Raceways & Boxes.”

2.5 IN-GROUND HANDHOLES

A. Construction:
   1. Minimum size 18"x18"x24"D, unless noted otherwise.
   2. Lightweight composite construction.
   3. Sand/aggregate mixture bound with polymer and reinforced with woven glass strands.
   4. Compressive strength 11,000 psi.
   5. Flexural strength 7,500 psi.
   6. Structural capacity of handhole and lid meeting AASHTO Tier 15 for loading (15,000 pound design load)
   7. Heavy duty textured covers, color matched to installed locations:
      a. Grass areas - Green.
      b. Asphalt areas - Black.
      c. Concrete areas - gray.
      d. Brick or pavers - brick red.
      e. Landscaped areas - brown or green.
   8. All components sunlight resistant.
10. Logo shall be integral with cover to indicate "ELECTRIC", "COMMUNICATION", "TELEPHONE", etc.
11. Open bottom.
12. Quazite Composolite or comparable product by Fiberlyte.

PART 3 EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions:
   1. Examine the site where the work is proposed.
   2. Make allowances where proposed work shall cross, intersect or otherwise be affected by existing conditions.

3.2 PREPARATION

A. Utility Coordination:
   1. Contact MISS UTILITY, national “811” or (1-800-257-7777) prior to any excavation or underground work. Arrange for marking of all utilities.
   2. Contact serving utility companies immediately upon award of contract. Do not install related equipment until fully coordinated with appropriate utilities.
   3. Provide all construction schedules, dates of requested services, outage windows, equipment locations, etc. necessary for utility work.

3.3 ENCASED & DIRECT BURIED CONDUIT INSTALLATION

A. General Requirements:
   1. Install nonmetallic conduit and duct as indicated according to manufacturer’s written instructions.
   2. Determine exact plans and profiles of underground conduit and ducts, based on field information and available as-built plans.
   3. Perform test pits at all utility crossings as shown on plans and available as-built drawings. Locate all shown utilities and structures, and make adjustments to proposed work.
   4. Verify location and inverts of existing utilities at proposed points of connection.
   5. Slope: Pitch ducts minimum of 4 inches per 100 feet (1:300) to drain toward handholes and away from buildings and equipment. Slope ducts from a high point in runs between handholes to drain in both directions.
   6. Make all conduit joints and fittings watertight per to manufacturer’s instructions.
   7. Stagger couplings so those of adjacent ducts do not lie in the same plane.

B. Curves and Bends: Use manufactured elbows with a minimum radius of 36" for stub-ups only at equipment and at building entrances. Use manufactured long sweep bends with a minimum radius of 25 feet both horizontally and vertically at other locations and for all telecomm applications.

C. Duct Entrances to Handholes: Provide horizontal penetration of conduit into handholes. Utilize manufacturer’s knockouts or field cut a punched hole opening for conduit. Gradually transition conduit from specified buried depth to knockout locations.
D. Building Entrances: Transition from underground conduit to interior conduit 10 feet minimum inside the building wall. Use fittings manufactured for the purpose. Follow appropriate installation instructions below.
1. Concrete-Encased Ducts: Install reinforcing in duct banks passing through disturbed earth near buildings and other excavations. Coordinate duct bank with structural design to support duct bank at wall without reducing structural or watertight integrity of building wall.
2. Direct-Buried, Non-encased Duct Entering Non-waterproofed Walls: Install a Schedule 40 galvanized-steel pipe sleeve for each duct. Caulk space between conduit and sleeve with duct-sealing compound on both sides for moisture-tight seal.
3. Waterproofed Wall and Floor Entrances: Install a watertight entrance-sealing device with the sealing gland assembly on the inside. Anchor device into masonry construction with 1 or more integral flanges. Secure membrane waterproofing to the device to make permanently watertight.

E. Separation Between Direct-Buried, Non-encased Ducts: 3 inches minimum for like services, and 6 inches minimum between power and signal ducts.

F. Concrete-Encased Nonmetallic Ducts:
1. Support on plastic separators coordinated with duct size and required duct spacing.
2. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, and secure separators to the earth and to ducts to prevent floating during concreting. Do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
3. Concreting: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not use power-driven agitating equipment unless specifically designed for duct bank application. Pour each run of envelope between other terminations in 1 continuous operation. When more than one pour is necessary, terminate each pour in a vertical plane and install: 1-inch reinforcing rod dowels extending 18 inches into the concrete on both sides of joint near the corners of the envelope.
4. Reinforcing: Reinforce duct banks where they cross disturbed earth and where indicated.
5. Forms: Use the walls of the trench to form the sidewalls of the duct bank where the soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
6. Minimum Clearances Between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts. Concrete envelope - 4 inches beyond surface of any conduit or duct.

G. Stub-Ups: Use Schedule 40 PVC conduit for stub-ups to equipment. For equipment mounted on outdoor concrete pads, extend conduit and terminate with end bell a minimum of 3" above pad.

H. Sealing: Provide temporary closure at terminations of ducts that are wired under this Project. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15 psi hydrostatic pressure.

I. Pulling Cord: Install 200-pound-test nylon cord in ducts, including each and every spare.
J. Buried Utility Marker Tape installed 12" below grade above every ductbank and buried conduit.

K. For direct buried <600 volt electrical circuits:
   1. Burial depth as required by NEC Article 300-5 and Table 300-5.
   2. Minimum separation from other utilities of 18.”

L. Ductbank Burial Depth and Separations:
   1. Top of envelope below grade - minimum as follows:
      a. 24 inches (600 volts and below)
   2. Separation from other buried utilities as follows:
      a. All utilities: 24"

M. Ductbank stubouts:
   1. Five feet out from manholes, minimum.
   2. Do not terminate under other ducts, concrete pads, pipes, etc. Extend stubout 5 feet past obstacle.
   3. Extend PVC ducts and rebar 18" past end of concrete to allow future tie in.
   4. Cap and seal all ducts to prevent water penetration.

3.4 HANDHOLE INSTALLATION

A. General:
   1. Install approximately where shown and where required for underground conduit runs exceeding 150LF. Exact location of each handhole shall be determined after careful consideration has been given to the location of other utilities, grading and paving.
   2. The location of each handhole shall be staked in field and approved before setting the handhole.
   3. Coordinate exact placement and elevation based on local grade, slope, other utilities, fences, roads and walkways, etc. which may affect location.
   4. Set level, and adjust for final, surrounding grade, such that lid is even with surrounding asphalt, concrete or soil.

B. Conduit and Duct Connections:
   1. Sidewall conduit penetrations shall be sealed with grout or waterproof sealant.
   2. All conduit ends shall have bell fittings, or nylon or plastic bushings to prevent damage to wire insulation when pulling.

C. Handhole Drainage:
   1. Set handholes on minimum 6-8" layer of clean, compacted gravel or stone for drainage (no dust).
   2. Provide filter fabric, placed between gravel and earth below handhole, and wrapped up along sides to prevent contamination of stone.

3.5 CONSTRUCTION

A. Excavation and Backfilling:
   1. General:
      a. Provide all excavating, backfill, compaction, seeding, sod and repair necessary to install underground electrical work.
      b. Establish all lines and grades required for the proper location of the work and be responsible for the correctness thereof.

02 58 80 - 6 UNDERGROUND DUCTS & WCPS: Boonsboro High School UTILITY STRUCTURES Auditorium & Stage Renovations
c. Verify location and check elevations of all existing utilities before starting work.
d. Keep banks of trenches as nearly vertical as possible, providing sheeting and shoring required for protection of work and safety of personnel.
e. Repair and/or replace any curbs, roads, walks, fences, utilities or structures disturbed as a result of the work in accordance with sections applicable to the work and to match the existing items.
f. Seed or sod all areas that are disturbed as a result of the work in accordance with sections applicable to the work.
g. Comply with all OSHA, federal, state and local requirements.

2. Excavation:
   a. Perform excavation in whatever material encountered. Use customary methods suitable for the area and type of work.
   b. Where excess excavation is made, back fill to required level with concrete.
   c. Excavate to the lines or grades indicated on the drawings or established in the field.
   d. Keep excavation drained and pumped out.
   e. Cover all open trenches.
   f. Install warning signs and flashers in accordance with applicable safety requirements.
   g. Erect safety barriers of substantial material to keep persons from work area. Barriers shall be constructed where directed and shall support warning signs on all sides.

3. Backfilling:
   a. Back fill to the required elevations and repair surfaces to their original condition.
   b. Use back fill material that is free from rocks, roots, stumps, brush, rubbish or other objectionable matter.
   c. Use no frozen material for backfilling and do not back fill on frozen material.
   d. Tamp back fill in 6 inch layers.
   e. Remove excess excavation not required or suitable for back fill.
   f. Minimum compaction shall be as follows:
      - 95% below equipment pads, duct banks, manholes, etc.
      - 95% for backfill below roads, walks or other paving and any vehicle or pedestrian traffic areas.
      - 90% for backfill in grass, or other non-paved areas.

B. Excavation and Backfilling:
   1. Perform all excavating and backfilling necessary to install underground ductbanks, manholes, cables, etc., included in this Division of the work. Excavation and back fill shall be performed in accordance with the requirements specified in Division 2 “Site Construction.”

C. Cutting and Patching:
   1. Provide all cutting and patching necessary for the installation of the electrical work. Any damage done to the work already in place by reason of this work, shall be repaired at the Installer's expense by a qualified mechanic experienced in such work. Patching shall be uniform in appearance and shall match with the surrounding surface.

D. Grounding:
   1. Refer to Division 16 Section “Grounding & Bonding” for specific requirements.
3.6 FIELD QUALITY CONTROL

A. General:
   1. Inspect all installed work after completion of rough and final grading to ensure no damage has occurred to installed components.
   2. Ensure final grading matches elevation of all installed components. Make adjustments, as required, to correct for settling, etc.
   3. Verify all handhole and manhole lid logos match the contained systems.

3.7 ADJUSTING

A. General:
   1. Make adjustments to manhole or handhole lid elevations to match final grades.
   2. Where lids will more than 1 inch lower than surrounding final grade, concrete, or asphalt, make adjustments to structure elevation, collar height, grading or concrete/asphalt installation to provide matched elevations.

3.8 CLEANING

A. Handholes:
   1. Remove all wire clippings, tape, loose debris, etc. from inside of all handholes.

B. Ducts & Conduit:
   1. After installation, but prior to installing cables, pull a mandrel sized ¼" less than conduit ID to confirm no blockages or collapsed ducts.
   2. Clean each installed conduit with a stiff brush to remove debris.

END OF SECTION
PART 1    GENERAL

1.1    SECTION INCLUDES

A.   Site storm sewerage drainage piping, fittings and accessories, and bedding.

1.2    PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A.   None.

1.3    RELATED SECTIONS

A.   Section 02 22 20 – Excavation
B.   Section 02 22 30 - Backfilling
C.   Section 02 22 50 - Trenching
D.   Section 02 53 80 – Sanitary Sewer System.

1.4    REFERENCES

A.   ANSI/ASTM C55 - Concrete Building Brick.
B.   ANSI/ASTM A74 - Cast Iron Soil Pipe and Fittings
C.   ANSI/ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
H.   ANSI/ASTM D3033 - Type PSP Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
I.   ANSI/ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
J.   ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
K.   ASTM A819 and A 760 – Aluminized Steel Pipe, Type II.
L.   AASHTO M252 or M294 for Polyethylene Plastic Drain Tube or Pipe.
M.   ASTM C478 - Precast Reinforced Concrete Manhole Sections.
N. ASTM C923 - Resilient Connectors between Reinforced Concrete Manhole Structures and Pipes.

O. Maryland State Highway Administration Standards and Specifications.

1.5 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.6 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Provide data indicating pipe, and pipe accessories.

C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

D. Manufacturer's Certificate: Certify that products meet or exceed requirements.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01 73 00.

B. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.8 REGULATORY REQUIREMENTS

A. Conform to applicable code for materials and installation of the Work of this section.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements and elevations are as indicated.

1.10 COORDINATION

A. Coordinate work with termination of storm sewer connection outside building, and trenching.

PART 2 PRODUCTS

2.1 SEWER PIPE MATERIALS

A. Concrete Pipe ASTM C76, Class III or IV gasketted joints.

B. Smooth Interior Corrugated Polyethylene Pipe: Conform to AASHTO M252 or M294, Type S. Pipe joints are to be (WT) watertight.
2.2 CATCH BASINS, MANHOLES, AND MISC. STRUCTURES
A. Refer to the City of Hagerstown Public Ways Construction Standards & Engineering Guidelines

2.3 BEDDING AND BACKFILL MATERIALS
A. Backfill – Type A (Coarse Stone) as specified in Section 02 22 30
B. Bedding: Fill Type B (Stone Dust) as specified in Section 02 22 30.
C. Backfill: Fill Type C – Graded Aggregate Base as specified in Section 02 22 30.

PART 3 EXECUTION
3.1 EXAMINATION
A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.
B. Verify items provided by other sections of Work are properly sized and located.
C. Verify that built-in items are in proper location, and ready for roughing into Work.
D. Verify excavation for structures/manholes is correct.

3.2 PREPARATION
A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.
B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING
A. Excavate pipe trench in accordance with Section 02 22 50 for work of this section. Hand trim excavation for accurate placement of pipe to elevations indicated.
B. Place bedding material at trench bottom, level materials in continuous layers not exceeding 6 inches of compacted depth for each layer required.
C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE
A. Install pipe, fittings, and accessories in accordance with ASTM C12 and manufacturer's instructions. Seal joints watertight.
B. Lay pipe to slope gradients noted on drawings; with maximum variation from true slope of 1/8 inch in 10 feet.
C. Install aggregate at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12 inches, compact to 95 percent.

D. Refer to Section 02 22 50 for trenching requirements. Do not displace or damage pipe when compacting.

E. Connect to building collection system.

3.5 INSTALLATION - CATCH BASINS, MANHOLES AND MISC. STRUCTURES

A. Form bottoms of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for storm sewer pipe End sections.

C. Level top surface of base pad to receive concrete shaft sections, sleeved to receive storm sewer pipe sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated.

E. Mount grate and frame level in grout, secured to top section to elevation indicated.

F. Form and place cast-in-place concrete flow channel in bottom of structures.

3.6 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 40 00.

B. Request inspection prior to and immediately after placing aggregate cover over pipe.

C. Compaction testing will be performed in accordance with ANSI/ASTM D1557.

D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

E. Frequency of Tests: Refer to Section 02 22 30.

3.7 PROTECTION

A. Protect finished Work under provisions of Section 01 50 00.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION
PART 1  GENERAL

1.1 SECTION INCLUDES

A. Industrial Grade Ornamental Fencing System including gates, pickets, rails, posts, closers, and associated hardware.

1.2 RELATED SECTIONS

A. Section 02 52 00 - Portland Cement Concrete Paving
B. Section 03 33 00 - Cast-in-Place Concrete.

1.3 SUBMITTALS

A. Shop Drawings: Layout of fence and gates with dimensions, details, and finishes of components, accessories and post foundations.
B. Product Data: Manufacturer’s catalog cuts indicating material compliance and specified options.
C. Samples: Color selection for polymer finishes. If requested samples of materials.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01 33 00.

1.5 WARRANTY

A. Ornamental Swing Gates: Provide manufacturer’s standard limited warranty that its ornamental swing gate system is free from defects in material and workmanship including cracking, peeling, blistering and corroding for a period of 15 years.

PART 2  PRODUCTS

2.1 MANUFACTURER

A. Products from qualified manufacturers having a minimum of 5 years experience manufacturing ornamental picket fencing will be acceptable by the architect as equal if they meet the following specifications for design, size, gauge of metal parts and fabrication.

B. Approved Manufacturer: Ameristar Fence Products Inc, Tulsa, Oklahoma (Basis of Design)

C. Style: Echelon II Majestic – 4 rails with rings; 7’-0” high.

D. Substitutions: Under provisions of Section 01 60 00.
2.2 MATERIAL

A. Aluminum material for fence framework (i.e., tubular pickets, rails and posts) shall conform to the requirements of ASTM B221. The aluminum extrusions for posts and rails shall be Alloy and Temper Designation 6005-T52. The aluminum extrusions for pickets and rail inner slide channels shall be alloy and Temper Designation 6063-T5.

B. The manufactured framework shall be subjected to a thermal stratification coating process (high-temperature, inline, multi-stage, multi-layer) including, as a minimum, a six-stage pretreatment/wash and an electrostatic spray application of polyester finish. The top coat shall be a “no-mar” TGIC polyester powder coat finish with a minimum thickness of 2 mils. The color shall be black. The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic shown in Table 1.

C. Material for fence pickets shall be 1” square x 0.065” thick extruded tubing. The cross-sectional shape of the rails shall conform to the manufacturer’s ForeRunner™ design with outside cross-section dimensions of 1.75” square. The top wall and internal web of the tail shall be 0.070” thick; the sidewalls shall be 0.070” thick for superior vertical load strength. Picket holes in the ForeRunner™ rail shall be spaced 4.715” o.c. Picket retaining rods shall be 0.125” diameter galvanized steel. Fence posts and gate posts shall meet the minimum size requirements of Table 2. High quality PVC grommets shall be supplied to seal all picket-to-rail intersections.

D. All fasteners shall be stainless steel. Bracket to rail attachments shall be made using specially designed one-way tamperproof security bolts with inverted “t-nuts”. Bracket to post connections shall be made using self-drilling hexhead screws.

E. Aluminum castings shall be used for all rings, post caps, finials, and miscellaneous adornments.

F. Mesh at Gate: Mesh utilized at gate to prevent access to the panic exit device outside of the secured perimeter shall be 1/2 inch, No. 0.051F flattened expanded aluminum with 1 inch aluminum “U” edging all (4) sides – to be provided by fence and gate manufacturer. Locate behind all gates and where noted on the drawings. Secure to pickets, posts, and gate framework using manufacture’s standard brackets.

G. Manufacturer to provide 1/4 inch thick aluminum brackets with shadow box construction welded to gate for securing exiting device. Dimension of box to be coordinated with approved exit device. Refer to Panic Device in Miscellaneous Hardware below.

2.3 FABRICATION

A. Pickets, rails and posts shall be pre-cut to specified lengths. ForeRunner™ rails shall be pre-punched to accept pickets.

B. The rail inner slide shall be fully inserted into the rail outer channel to form the raceway for the internal retaining rod. Grommets shall be inserted into the pre-punched holes in the rails, and pickets shall be inserted through the grommets so that pre-drilled picket holes align with the internal raceway of the two-part ForeRunner™ rails. (Note: This can best be accomplished by using an alignment template). Retaining rods shall be inserted into each ForeRunner™ rail so that they pass through pre-drilled holes in each picket, thus completing the panel assembly.
PART 3 EXECUTION

3.1 PREPARATION

A. All new installation shall be laid out by the contractor in accordance with the construction plans.

3.2 INSTALLATION

A. Fence posts shall be set in accordance with the spacings shown in Table 2, plus or minus ½", depending on the nominal span specified. Gate posts shall be spaced according to the gate openings specified in the construction plans. The “Earthwork” and “Concrete” sections of this specification shall govern post base material requirements. Echelon II™ panels shall be attached to posts using mechanically fastened panel brackets supplied by the manufacturer. Posts shall be set in concrete footings having a minimum depth of 36” or greater as required by manufacturer to resist overturning.
3.3 CLEANING

A. The contractor shall clean the jobsite of excess materials; pole-hole excavations shall be scattered uniformly away from posts.

TABLE 1 – Coating Performance Requirements

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<tr>
<th>Quality Characteristics</th>
<th>ASTM Test Method</th>
<th>Performance Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adhesion</td>
<td>D3359 – Method B</td>
<td>Adhesion (Retention of Coating) over 90% of test area (tape and knife test)</td>
</tr>
<tr>
<td>Corrosion Resistance</td>
<td>B117 &amp; D1654</td>
<td>Corrosion Resistance over 1,000 hours (Scribed per D1654; failure mode is 1/8” coating loss from scribe or medium #8 blisters)</td>
</tr>
<tr>
<td>Impact Resistance</td>
<td>D2794</td>
<td>Impact Resistance over 60 inch lb. (Forward impact using 0.625” ball)</td>
</tr>
<tr>
<td>Weathering Resistance</td>
<td>D822, D2244, D523 (60° Method)</td>
<td>Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units)</td>
</tr>
</tbody>
</table>

TABLE 2 – Post Spacing Requirements

<table>
<thead>
<tr>
<th>Fence Posts</th>
<th>Panel Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-1/2” x 2-1/2” x .080” Alum. w/ reinforced web</td>
<td>Up to &amp; Including 6’ Height</td>
</tr>
<tr>
<td>3” x 3” x .120” Alum.</td>
<td>Over 6’ Up to Including 8’ Height</td>
</tr>
<tr>
<td>4” x 4” x .250 Alum.</td>
<td>Over 8’ Height Up to 10’</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gate Leaf</th>
<th>Gate Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 4’</td>
<td>6’ x 3/16” steel</td>
</tr>
<tr>
<td>3” x 3” x .120 Alum.</td>
<td>6” x 3/16” steel</td>
</tr>
<tr>
<td>4” x 4” x .250 Alum. Or 3” x 12 Ga. steel</td>
<td>6” x 3/16” steel</td>
</tr>
<tr>
<td>3” x 12 Ga. Steel</td>
<td>6” x 3/16” steel</td>
</tr>
<tr>
<td>4” x 11 Ga. steel</td>
<td>6” x 3/16” steel</td>
</tr>
<tr>
<td>4” x 11 Ga. steel</td>
<td>6” x 3/16” steel</td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES
   A. Final grade topsoil for trees, shrubs and ground cover plantings.

1.2 RELATED SECTIONS
   A. Section 01 10 00 – Summary.
   B. Section 02 93 60 - Seeding: Topsoil for seeding.
   C. Section 02 93 80 – Sodding: Topsoil for sodding.
   D. Section 02 95 00 – Trees, Shrubs and Ground Cover: Topsoil for plantings.

PART 2 PRODUCTS

2.1 MATERIAL
   A. Topsoil shall be the existing surface soil stripped to the depth determined by the
      Geotechnical Engineer and stockpiled on site and amended by the addition of pH
      adjusted and soil conditioners at a rate based on the soil analysis recommendations.
      The resultant pH shall be 6.0 and 6.5.
   B. Additional topsoil beyond that of which is available from stripping operations shall
      conform to MSHA Specification Section 920.01
   C. All Soil Testing is to be done by Contractor at their expense.

PART 3 EXECUTION

3.1 EXAMINATION
   A. Verify building and trench backfilling has been inspected.
   B. Verify substrate base has been contoured and compacted.

3.2 SUBSTRATE PREPARATION
   A. Eliminate uneven areas and low spots.
   B. Topsoil located outside of the building areas: Remove debris, roots, branches and stones in excess of 1-inch in size.

3.3 PLACING TOPSOIL
   A. Place topsoil in areas for planting beds to thickness as scheduled. Place topsoil during dry weather.
   B. Fine grade topsoil eliminating rough or low areas. Maintain profiles and contour of subgrade.
   C. Remove roots, weeds, rocks and foreign material while spreading.
D. Manually spread topsoil close to trees, plants, building, and sidewalks to prevent damage.

E. Lightly compact placed topsoil.

F. Remove surplus subsoil from site at no additional cost to the Owner.

3.4 TOLERANCES
   A. Top of Topsoil: Plus or minus 1/2 inch.

3.5 PROTECTION
   A. Protect landscaping and other features remaining as final work.
   B. Protect existing structures, fences, sidewalks, utilities, paving and curbs.

3.6 SCHEDULES
   A. Compacted topsoil thickness at the following areas:

      1. Shrub Beds and Planting Beds: 18 inches
      2. Lawn Area: 4 inches

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Permanent seeding, mulching and fertilizer for playing fields and green areas around buildings.

B. Maintenance

1.2 RELATED SECTIONS

A. Section 02 92 30 - Landscape Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this Section.

B. Section 02 95 00 - Trees, Shrubs, and Ground Cover.

1.3 REFERENCES

A. FS O-F-241 - Fertilizers, Mixed, Commercial.

1.4 DEFINITIONS


1.5 MAINTENANCE DATA

A. Submit under provisions of Section 01 73 00.

B. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

1.6 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

1.7 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of seed mixture.

C. Provide soils analysis report per Article 2.03.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.
C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.9 COORDINATION
A. Coordinate work under provisions of Section 01 33 00.

1.10 MAINTENANCE SERVICE
A. Maintain seeded areas immediately after placement until grass is well established and exhibits a vigorous growing condition and until contract completion.

PART 2 PRODUCTS

2.1 SEED MIXTURE
A. General Seed Blend
   Tall Turf Type Fescue 85%
   Kentucky Blue 5%
   Perennial Rye 10%

B. Steep Grade Blend - All slopes steeper than 2.5:1 Horizontal to Vertical:
   Annual Rye 28%
   Red Clover 12%
   Switchgrass 8%
   Deertongue 12%
   Wild Rye 12%
   Gama Grass 8%
   Red Top 20%

2.02 ACCESSORIES
A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.
B. Fertilizer: FS O-F-241, Type recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated in analysis.
C. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.
D. Erosion Fabric: Jute matting, open weave.
E. Herbicide: As approved by seeding manufacturer.
F. Stakes: Softwood lumber, chisel pointed.
G. String: Inorganic fiber.

2.3 TESTS
A. Provide analysis of any topsoil under provisions of Section 01 40 00.
B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.
C. Submit minimum 10 oz sample of imported topsoil proposed. Forward sample to approved testing laboratory in sealed containers to prevent contamination.
PART 3  EXECUTION

3.1   EXAMINATION
   A.   Verify that prepared soil base is ready to receive the work of this Section.

3.2   FERTILIZING
   A.   Apply fertilizer in accordance with manufacturer's instructions.
   B.   Apply after smooth raking of topsoil and prior to roller compaction.
   C.   Do not apply fertilizer at same time or with same machine as will be used to apply seed.
   D.   Mix thoroughly into upper 2 inches of topsoil.
   E.   Lightly water to aid the dissipation of fertilizer.

3.3   SEEDING
   A.   Apply seed at a rate of 240 lbs. per acre.  Rake in lightly.
   B.   Do not seed areas in excess of that which can be mulched on same day.
   D.   Do not sow immediately following rain, when ground is too dry, or during windy periods.
   E.   Roll seeded area with roller not exceeding 112 lbs.
   F.   Immediately following seeding and compacting, apply mulch to a thickness of 1/8 in.  Maintain clear of shrubs and trees.
   G.   Apply water with a fine spray immediately after each area has been mulched.  Saturate to 4 inches of soil.
   H.   Hydroseeding is an approved alternate application method.

3.4   SEED PROTECTION
   A.   Identify seeded areas with stakes and string around area periphery.  Set string height to 36 inches.  Space stakes at 96 inches.

3.5   MAINTENANCE
   A.   Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches.  Do not cut more than 1/3 of grass blade at any one mowing.  Maintain maintenance throughout the construction contract.
   B.   Neatly trim edges and hand clip where necessary.
   C.   Immediately remove clippings after mowing and trimming.
   D.   Water to prevent grass and soil from drying out.
   E.   Roll surfaces to remove minor depressions or irregularities.
F. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.

G. Immediately re-seed areas which show bare spots.

H. Protect seeded areas with warning signs during maintenance period.

I. Provide minimum one each fall, winter, and spring fertilizing utilizing products approved by the Owner and application rates as required from soil analysis.

J. Maintain grass until substantial completion and until substantial completion and until stand of grass is full and acceptable to the Owner/Architect.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES
A. Preparation of subsoil.
B. Placing topsoil.
C. Fertilizing.
D. Sod installation.
E. Maintenance.

1.2 RELATED SECTIONS
A. Section 01 10 00 - Summary: Work by others.
B. Section 01 20 00 - Price and Payment Procedures: Unit Prices
C. Section 02 22 30 - Backfilling: Rough grading of site.
D. Section 02 22 50 - Trenching: Rough grading over cut.
E. Section 02 92 30 - Landscape Grading: Preparation of subsoil and placement of topsoil in preparation for the Work of this Section.
F. Section 02 93 60 - Seeding.
G. Section 02 95 00 - Trees, Plants, and Ground Cover.

1.3 REFERENCES
A. ASPA (American Sod Producers Association) - Guideline Specifications to Sodding.
B. FS O-F-241 - Fertilizers, Mixed, Commercial.

1.4 DEFINITIONS

1.5 MAINTENANCE DATA
A. Submit under provisions of Section 01 73 00.
B. Operation Data: Submit for continuing Owner maintenance.
C. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; application frequency, and recommended coverage of fertilizer.
1.6 QUALITY ASSURANCE
A. Sod: Minimum age of 18 months, with root development that will support its own weight without tearing, when suspended vertically by holding the upper two corners.
B. Submit sod certification for grass species and location of sod source.

1.7 QUALIFICATIONS
A. Sod Producer: Company specializing in sod production and harvesting with a minimum of five years experience, and certified by the State of Maryland.
B. Installer: Company approved by the sod producer.

1.8 REGULATORY REQUIREMENTS
A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.9 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.
B. Deliver sod on pallets. Protect exposed roots from dehydration.
C. Do not deliver more sod than can be laid within 24 hours.

1.10 COORDINATION
A. Coordinate work under provisions of Section 01 33 00.

1.11 MAINTENANCE SERVICE
A. Furnish service and maintenance of sodded areas for three months from Date of Substantial Completion

PART 2 PRODUCTS

2.1 MATERIALS
A. Sod: ASPA Certified Approved Field grown; cultivated grass sod; with strong fibrous root system, free of stones, burned or bare spots; containing no more than 10 weeds per 1000 sq. ft.
B. Topsoil: As specified in Section 02 92 30.
C. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

2.3 ACCESSORIES
A. Wood Pegs: Softwood, sufficient size and length to ensure anchorage of sod on slope.
B. Wire Mesh: Interwoven hexagonal plastic mesh of 2 inch size.

2.4 HARVESTING SOD
A. Machine cut sod and load on pallets in accordance with ASPA Guidelines.
2.5 TESTS
A. Provide analysis of topsoil fill under provisions of Section 01 0 400.

B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.

C. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify that prepared soil base is ready to receive the work of this section.

3.2 PREPARATION OF SUBSOIL
A. Prepare sub-soil and eliminate uneven areas and low spots.

B. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

C. Remove foreign materials and undesirable plants and their roots. Do not bury foreign material beneath areas to be sodded.

D. Remove contaminated subsoil.

E. Scarify sub-soil to a depth of 4 inches where topsoil is to be placed.

F. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.

3.3 PLACING TOPSOIL
A. Spread topsoil to a minimum depth of 2 inches over area to be sodded.

B. Place topsoil during dry weather and on dry unfrozen subgrade.

C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.

D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

3.4 FERTILIZING
A. Apply fertilizer in accordance with manufacturer's instructions.

B. Apply after smooth raking of topsoil and prior to installation of sod.

C. Apply fertilizer no more than 48 hours before laying sod.

D. Mix thoroughly into upper 2 inches of topsoil.

E. Lightly water to aid the dissipation of fertilizer.
3.5 LAYING SOD
A. Moisten prepared surface immediately prior to laying sod.
B. Lay sod immediately after delivery to site within 24 hours after harvesting to prevent deterioration.
C. Lay sod tight with no open joints visible, and no overlapping; stagger end joints 12 inches (300 mm) minimum. Do not stretch or overlap sod pieces.
D. Lay smooth. Align with adjoining grass areas.
E. Place top elevation of sod even with adjoining sidewalks.
F. On slopes 6 inches per foot and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2 feet on center. Drive pegs flush with soil portion of sod.
G. Prior to placing sod, on slopes exceeding 8 inches per foot, place mesh over topsoil. Securely anchor in place with wood pegs sunk firmly into the ground.
H. Water sodded areas immediately after installation. Saturate sod to 4 inches of soil.
I. After sod and soil have dried, roll sodded areas to ensure good bond between sod and soil and to remove minor depressions and irregularities.

3.6 MAINTENANCE
A. Mow grass at regular intervals to maintain at a maximum height of 2-1/2. Do not cut more than 1/3 of grass blade at any one mowing.
B. Neatly trim edges and hand clip where necessary.
C. Immediately remove clippings after mowing and trimming.
D. Water to prevent grass and soil from drying out.
E. Roll surface to remove or irregularities.
F. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
G. Immediately replace sod to areas which show deterioration or bare spots.
H. Protect sodded areas with warning signs during maintenance period.
I. Provide minimum one each fall, winter, and spring fertilizing utilizing products approved by the Owner and application rates as required from soil analysis.
J. Maintain grass until substantial completion and until substantial completion and until stand of grass is full and acceptable to the Owner/Architect.

END OF SECTION
PART 1  GENERAL

1.01  SECTION INCLUDES
   A. New trees, shrubs, and ground cover for landscaping
   B. Mulch and fertilizer.
   C. Maintenance.

1.02  RELATED SECTIONS
   A. Section 02 92 30 - Landscape Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this Section.
   B. Section 02 93 60 - Seeding.
   C. Section 02 93 80 - Sodding.

1.03  REFERENCES
   A. FS O-F-241 - Fertilizers, Mixed, Commercial.
   B. ANSI Z60.1 - Nursery Stock.

1.04  DEFINITIONS
   B. Plants: Living trees, shrubs, and ground cover specified in this Section, and described in ANSI Z60.1.

1.05  MAINTENANCE DATA
   A. Submit under provisions of Section 01 73 00.
   B. Operation Data: Submit for continuing Owner maintenance.
   C. Maintenance Data: Include cutting and trimming method; types, application frequency, and recommended coverage of fertilizer.

1.06  QUALITY ASSURANCE
   A. Provide inspection and testing for verifying acceptability of plants, robustness, and life expectancy.
1.07 QUALIFICATIONS

A. Nursery: Company specializing in growing and cultivating the plants with three years documented experience.

B. Installer: Company specializing in installing and planting the plants with three years documented experience approved by nursery.

C. Maintenance Services: Performed by installer.

1.08 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of plants, fertilizer and herbicide mixture.

C. Plant Materials: Free of disease or hazardous insects.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 1.

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

C. Protect plants until planted.

D. Deliver plant life materials immediately prior to placement. Keep plants moist.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not install plant life when ambient temperatures may drop below 35 degrees F or above 90 degrees F.

B. Do not install plants when wind velocity exceeds 30 mph.

1.11 COORDINATION

A. Coordinate work under provisions of Section 01 31 00.

1.12 WARRANTY

A. Provide one year warranty from date of substantial completion under provisions of Section 01700 for landscape plantings.

B. Landscape Warranty: Include coverage for one continuous growing season; replace dead or unhealthy plants.

C. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.
1.13 GENERAL MAINTENANCE SERVICE

A. Maintain landscape plant life immediately after placement until plants are well established and exhibits a vigorous growing condition. Continue maintenance until termination of warranty period.

B. Landscape Maintenance to include:
   1. Cultivation and weeding plant beds and tree pits.
   2. Applying herbicides for weed control in accordance with manufacturer's instructions. Remedy damage resulting from use of herbicides.
   3. Remedy damage from use of insecticides.
   4. Irrigating sufficient to saturate root system.
   5. Pruning, including removal of dead or broken branches, and treatment of pruned areas or other wounds.
   6. Disease control.
   7. Maintaining wrapping, guys, turnbuckles, and stakes. Adjust turnbuckles to keep guy wires tight. Repair or replace accessories when required.

PART 2 PRODUCTS

2.01 TREES, SHRUBS, AND GROUND COVER (Not Applicable)

A. Trees, Shrubs and Ground Cover: Species and size identifiable in plant schedule, grown in climatic conditions similar to those in locality of the Work.

2.02 SOIL MATERIALS

A. Topsoil: Excavated from site or imported.

B. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; minimum pH value of 5.4 and maximum 7.0.

2.03 SOIL AMENDMENT MATERIALS

A. Fertilizer: FS O-F-241; as recommended; with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated in analysis.

B. Peat Moss: Shredded, loose, sphagnum moss; free of lumps, roots, inorganic material or acidic materials; minimum of 85 percent organic material measured by oven dry weight, pH range of 4 to 5; moisture content of 30 percent.

C. Bone Meal: Raw, finely ground, commercial grade, minimum of 3 percent nitrogen and 20 percent phosphorous.

D. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates.

E. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of plants.

F. Herbicide: As recommended by Nursery.
G. Pesticide: As recommended by Nursery.

2.04 MULCH MATERIALS

A. Mulching Material: Southern pine needles, free of growth or germination inhibiting ingredients.

2.05 ACCESSORIES

A. Wrapping Materials: Burlap.
B. Stakes: Softwood lumber, pointed end.
C. Cable, Wire, Eye Bolts and Turnbuckles: Non-corrosive, of sufficient strength to withstand wind pressure and resultant movement of plant life.
D. Plant Protectors: Rubber sleeves over cable to protect plant stems, trunks, and branches.
E. Membrane: 20 mil thick, black water permeable polyolefin fabric.
F. Edging: Equal to Permaloc “Clean Line XL” series, aluminum, 3/16” x 6”; Color: Black Duraflex.

2.06 TESTS

A. Provide analysis of any imported topsoil under provisions of Section 01 40 00.
B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt and organic matter; and pH value.
C. Submit minimum 10 oz sample of topsoil proposed. Forward sample to testing laboratory in sealed containers to prevent contamination.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared subsoil is ready to receive work.
B. Saturate soil with water to test drainage.

3.02 PREPARATION OF SUBSOIL

A. Prepare subsoils to eliminate uneven areas. Maintain profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated subsoil.
C. Scarify subsoils to a depth of 3 inches where plants are to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.
D. Dig pits and beds 6 inches larger than plant root system.
3.03 FERTILIZING
   A. Apply fertilizer in accordance with manufacturer's instructions.
   B. Apply after initial raking of topsoil.
   C. Mix thoroughly into upper 2 inches of topsoil.
   D. Lightly water to aid the dissipation of fertilizer.

3.04 PLANTING
   A. Place plants in accordance with drawings.
   B. Set plants vertical.
   C. Remove non-biodegradable root containers.
   D. Set plants in pits or beds, partly filled with prepared topsoil mixture, at a minimum depth of 6 inches under each plant. Remove or loosen burlap, ropes, and wires, from the root ball.
   F. Saturate soils with water when the pit or bed is half full of top soil and again when full.
   G. Apply mulches as detailed.

3.05 TREE SUPPORT (Not Applicable)
   A. Brace trees vertically with plant protector wrapped guy wires and stakes to the following:

<table>
<thead>
<tr>
<th>Tree Caliper</th>
<th>Tree Support Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 inch (25 mm)</td>
<td>1 stake with one tie</td>
</tr>
<tr>
<td>1 - 2 inches (25 - 50 mm)</td>
<td>2 stakes with two ties</td>
</tr>
<tr>
<td>2 - 4 inches (50 - 100 mm)</td>
<td>3 guy wires with eye bolts and turn buckles</td>
</tr>
<tr>
<td>Over 4 inches (100 mm)</td>
<td>4 guy wires with eye bolts and turn buckles</td>
</tr>
</tbody>
</table>

3.06 FIELD QUALITY CONTROL
   A. Field inspection will be performed under provisions of Division 1.
   B. Plants will be rejected if a ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

3.07 MAINTENANCE
   A. Neatly trim plants where necessary.
   B. Immediately remove clippings after trimming.
   C. Water to prevent soil from drying out.
D. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.

E. Apply pesticides in accordance with manufacturer’s instructions. Remedy damage resulting from improper use of pesticides.

END OF SECTION
PART 1  GENERAL

1.1  SECTION INCLUDES

A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.
B. Openings for other work.
C. Form accessories.
D. Form stripping.

1.2  PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Section 03 30 00 - Cast-In-Place Concrete: Supply of concrete accessories for placement by this Section.
B. Section 05 50 00 - Metal Fabrications: Supply of metal fabrications for placement by this Section.

1.03  RELATED SECTIONS

A. Section 03 20 00 - Concrete Reinforcement.
B. Section 03 30 00 - Cast-In-Place Concrete.
C. Section 03 45 10 - Architectural Precast Concrete: Specially surfaced concrete.

1.4  REFERENCES

A. ACI 347 - Recommended Practice For Concrete Formwork.
C. PS-1 - Construction and Industrial Plywood.

1.5  DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing to conform to code requirements; resultant concrete to conform to required shape, line and dimension.

1.6  SUBMITTALS

A. Submit under provisions of Section 01 33 00.
B. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.
C. Product Data: Provide data on void form materials and installation requirements.
1.7 QUALITY ASSURANCE
   A. Perform Work in accordance with ACI 347, 301 and 318.
   B. Maintain one copy of each document on site.

1.8 QUALIFICATIONS
   A. Design formwork under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Maryland.

1.9 REGULATORY REQUIREMENTS
   A. Conform to IBC code for design, fabrication, erection and removal of formwork.

1.10 DELIVERY, STORAGE, AND HANDLING
   A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.
   B. Deliver void forms and installation instructions in manufacturer's packaging.
   C. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.11 COORDINATION
   A. Coordinate work under provisions of Section 01 31 00.
   B. Coordinate this Section with other Sections of work which require attachment of components to formwork.
   C. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement, request instructions from Architect/Engineer before proceeding.

PART 2 PRODUCTS

2.1 WOOD FORM MATERIALS
   A. Form Materials: Per schedule at the end of this section.

2.2 PREFABRICATED FORMS
   A. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
   B. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.
   C. Pan Type: Steel of size and profile required.
   D. Tubular Column Type: Round, spirally wound laminated fiber material, surface treated with release agent, non-reusable, of sizes required.
2.3 FORMWORK ACCESSORIES

A. Form Ties: Snap-off type, galvanized metal, adjustable length, one inch back break dimension, free of defects that could leave holes larger than 1-1/4 inch in concrete surface.

B. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.

C. Corners: Chamfered, wood strip type; maximum possible lengths.

D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

E. Waterstops: Polyvinyl chloride, min. 1,750 psi tensile strength, min. 50EF to plus 175EF working temperature range, 1/2 inch wide, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing; manufactured by Dur-o-wall.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with Drawings.

3.2 EARTH FORMS

A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.3 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

E. Obtain approval before framing openings in structural members which are not indicated on Drawings.

F. Provide chamfer strips on external corners of beams and miscellaneous concrete work.

G. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.

3.4 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are effected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in or passing through concrete work.

B. Locate and set in place items which will be cast directly into concrete.

C. Coordinate work of other Sections in forming and placing openings, slots, reglets, recesses, chases, sleeves, bolts, anchors, and other inserts.

D. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Install waterstops continuous without displacing reinforcement. Heat seal joints watertight.

F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.6 FORM CLEANING

A. Clean and remove foreign matter within forms as erection proceeds.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts or water to clean out forms, unless formwork and concrete construction proceed within heat enclosure. Use compressed air or other means to remove foreign matter.

3.7 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

B. Camber slabs and beams 1/4 inch per 10 feet in accordance with ACI 301.

3.8 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

B. Do not reuse wood formwork more than two times for concrete surfaces to be exposed to view. Do not patch formwork.

3.9 FORM REMOVAL
A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

3.10 SCHEDULES

A. Foundation Walls Not Exposed to View: Site fabricated plywood or steel pan coated with form oil.

B. Foundation Walls Exposed to View: Smooth steel pan coated with form oil.

END OF SECTION
PART 1   GENERAL

1.1 SECTION INCLUDES


1.2 RELATED SECTIONS

A. Section 02 52 00 - Portland Cement Concrete Paving.
B. Section 03 10 00 - Concrete Formwork.
C. Section 03 30 00 - Cast-in-Place Concrete.
D. Section 03 34 60 - Concrete Floor Finishing: Reinforcement
E. Section 03 45 10 - Architectural Precast Concrete: Reinforcement

1.3 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.
B. ACI 318 - Building Code Requirements for Reinforced Concrete.
C. ACI SP-66 - American Concrete Institute - Detailing Manual.
D. ANSI/ASTM A82 - Cold Drawn Steel Wire for Concrete Reinforcement.
E. ANSI/ASTM A184 - Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
F. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
G. ANSI/ASTM A496 - Deformed Steel Wire Fabric for Concrete Reinforcement.
H. ANSI/ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
I. ANSI/AWS D1.4 - Structural Welding Code for Reinforcing Steel.
K. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
L. ASTM A704 - Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
M. AWS D12.1 - Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction.
N. CRSI - Concrete Reinforcing Steel Institute Manual of Practice.
O. CRSI 63 - Recommended Practice for Placing Reinforcing Bars.

P. CRSI 65 - Recommended Practice for Placing Bar Supports, Specifications and
Nomenclature.

1.4 SUBMITTALS
   A. Submit under provisions of Section 01 33 00.
   B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices.
   C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE
   A. Perform Work in accordance with ACI 301 and ACI 318.
   B. Maintain one copy of each document on site.
   C. Provide Architect/Engineer with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.

1.6 COORDINATION
   A. Coordinate work under provisions of Section 01 31 00.
   B. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT
   A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars, plain to ASTM A767, Class I finish.
   B. Welded Steel Wire Fabric: ASTM A185 Plain Type in flat sheets; Class I finish.

2.2 ACCESSORY MATERIALS
   A. Tie Wire: Minimum 16 gage annealed type.
   B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture.
   C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated Stainless-steel type; size and shape as required.

2.3 FABRICATION
   A. Fabricate concrete reinforcing in accordance with ACI 318.
   B. Weld reinforcement in accordance with ANSI/AWS D1.4.
   C. Locate reinforcing splices not indicated on Drawings, at point of minimum stress. Review location of splices with Architect/Engineer.
PART 3  EXECUTION

3.1  PLACEMENT

A.  Place, support and secure reinforcement against displacement.  Do not deviate from required position.

B.  Do not displace or damage vapor barrier.

C.  Accommodate placement of formed openings.

D.  Maintain concrete cover around reinforcing as follows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beams</td>
<td>2 inch</td>
</tr>
<tr>
<td>Supported Slabs and Joists</td>
<td>1 inch</td>
</tr>
<tr>
<td>Column Ties</td>
<td>1-1/2 inch</td>
</tr>
<tr>
<td>Walls (exposed to weather or backfill)</td>
<td>2 inch</td>
</tr>
<tr>
<td>Footings and Concrete Formed Against Earth</td>
<td>3 inch</td>
</tr>
<tr>
<td>Slabs on Fill</td>
<td>Mid depth</td>
</tr>
</tbody>
</table>

3.2  FIELD QUALITY CONTROL

A.  Field inspection will be performed under provisions of Section 01 40 00.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cast-in-place concrete building frame members, floors, shear walls, foundation walls, and supported slabs.

B. Floors and slabs on grade.

C. Beneath slab vapor barriers for general slabs and slabs with athletic wood floors.

D. Control, expansion, and contraction joint devices associated with concrete work.

E. Equipment pads, light pole base, flagpole base, thrust blocks, and miscellaneous items.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 03 10 00 - Concrete Formwork: Placement of joint device and joint device anchors in formwork.

1.3 RELATED SECTIONS

A. Section 02 22 30 - Backfilling: Aggregate base.

B. Section 02 36 10 - Termite Control: Placement of termite control prior to pouring of building concrete slab.

C. Section 02 52 00 - Portland Cement Concrete Paving: Sidewalks, curbs and gutters.

D. Section 03 10 00 - Concrete Formwork: Formwork and accessories.

E. Section 03 20 00 - Concrete Reinforcement.

F. Section 03 34 60 - Concrete Floor Finishing.

G. Section 03 37 00 - Concrete Curing.

H. Division 5 - Metals: Anchors for structural systems.

I. Section 07 26 10 – Below Grade Vapor Retarders.

J. Section 07 90 00 - Joint Sealers.

K. Division 22 – Plumbing: Plumbing items for casting into concrete.

L. Division 23 - Mechanical: Mechanical items for casting into concrete.

M. Division 26 - Electrical: Electrical items for casting into concrete.

1.4 REFERENCES
A. ACI 301 - Structural Concrete for Buildings.
B. ACI 302 - Guide for Concrete Floor and Slab Construction.
C. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
D. ACI 305R - Hot Weather Concreting.
E. ACI 306R - Cold Weather Concreting.
F. ACI 308 - Standard Practice for Curing Concrete.
G. ACI 318 Building Code Requirements for Reinforced Concrete.
H. ANSI/ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous Type).
I. ANSI/ASTM D1190 - Concrete Joint Sealer, Hot-Poured Elastic Type.
J. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
K. ANSI/ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
L. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
M. ASTM C33 - Concrete Aggregates.
N. ASTM C94 - Ready-Mixed Concrete.
O. ASTM C150 - Portland Cement.
P. ASTM C260 - Air Entraining Admixtures for Concrete.
Q. ASTM C330 - Light Weight Aggregates for Structural Concrete.
R. ASTM C494 - Chemicals Admixtures for Concrete.
S. ASTM C618 - Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.
B. Product Data: Provide data on joint devices, attachment accessories, admixtures and curing compounds.

C. Submit mix designs (by a qualified testing laboratory) for pea gravel and normal concrete. Submit procedures to be followed for hot weather and cold weather
construction. Submittals must be made prior to any installations.

1.6 PROJECT RECORD DOCUMENTS
A. Submit under provisions of Section 01 73 00.
B. Accurately record actual locations of embedded utilities and components which are concealed from view.

1.7 QUALITY ASSURANCE
A. Perform Work in accordance with ACI 301.
B. Acquire cement and aggregate from same source for all work.
C. Conform to ACI 305R when concreting during hot weather.
D. Conform to ACI 306R when concreting during cold weather.

18 COORDINATION
A. Coordinate work under provisions of Section 01 31 00.
B. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS
A. Cement: ASTM C150, Type I - Normal Portland type; manufactured by St. Lawrence Cement or Lehigh Cement Co.
C. Water: Clean and not detrimental to concrete.

2.2 ADMIXTURES
A. Air Entrainment: ASTM C260; Daravair 1,000 or equal manufactured by W. R. Grace.
B. Chemical: ASTM C494, Type A - Water Reducing, Type D - Water Reducing and Retarding, Type E - Water Reducing and Accelerating, admixture; such as Dozough manufactured by Master Builders.

2.3 ACCESSORIES
A. Bonding Agent: Two component modified epoxy resin.
B. Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.
2.4 JOINT DEVICES AND FILLER MATERIALS

A. Joint Filler Type A: Flexible foam expansion joint filler complying with ASTM D1752, Sections 5.1 through 5.4; 1/2 inch thick, equal to Ceramar by W. R. Meadows with water absorption of 0.246% of volume as tested in accordance with ASTM D545.

B. Construction Joint Devices: Integral; 1/8 inch thick, formed to tongue and groove profile, with removable top strip exposing sealant trough, knockout holes spaced at 6 inches, ribbed steel spikes with tongue to fit top screed edge.

C. Sealant and Primer: Type, as specified in Section 07 90 00.

2.5 CONCRETE MIX

A. Mix and deliver concrete in accordance with ASTM C94, Alternative No. 2.

B. Select proportions for normal weight concrete in accordance with ACI 301 Method 2.

C. Provide concrete to the following criteria:

<table>
<thead>
<tr>
<th>Design Mix</th>
<th>7 Day Strength</th>
<th>28 Day Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,000 psi</td>
<td>1,950 psi</td>
<td>3,000 psi</td>
</tr>
<tr>
<td>4,000 psi</td>
<td>2,600 psi</td>
<td>4,000 psi</td>
</tr>
</tbody>
</table>

2. Slump: per ASTM C-94.

D. Use accelerating admixtures in cold weather only when approved by Architect/Engineer. Use of admixtures will not relax cold weather placement requirements.

E. Use of calcium chloride shall be prohibited.

F. Use set retarding admixtures during hot weather only when approved by Architect/Engineer.

G. Add air entraining agent to normal weight concrete mix for work exposed to exterior at 5-7 percent air content.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions under provisions of Section 01 31 00.

B. Verify requirements for concrete cover over reinforcement.

C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.2 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

3.3 PLACING CONCRETE

A. Place concrete in accordance with ACI 304, ACI 301, ACI 318.

B. Notify Architect/Engineer minimum 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, formed joint fillers and joint devices are not disturbed during concrete placement.

D. Install vapor barrier under interior slabs on grade. Lap joints minimum 6 inches and seal watertight by sealant applied between overlapping edges and ends or taping edges and ends.

E. Repair vapor barrier damaged during placement of concrete reinforcing. Repair with vapor barrier material; lap over damaged areas minimum 6 inches and seal watertight.

F. High Performance Vapor Barriers used in conjunction with Athletic Wood Floor Vapor Beneath Slab Vapor Barriers shall be installed in accordance with the manufacturer’s written instructions with self-adhered taped laps.

G. Install joint fillers, primer and sealant in accordance with manufacturer's instructions.

H. Separate slabs on grade from vertical surfaces with 1/2 inch thick joint filler.

I. Extend joint filler from bottom of slab to within 1/2 inch of finished slab surface. Conform to Section 07 90 00 for finish joint sealer requirements.

J. Install joint devices in accordance with manufacturer's instructions.

K. Install construction joint device in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

L. Install joint device anchors. Maintain correct position to allow joint cover flush with floor and wall finish.

M. Install joint covers in longest practical length, when adjacent construction activity is complete.

N. Apply sealants in joint devices in accordance with Section 07 90 00.

O. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

P. Place concrete continuously between predetermined expansion, control, and construction joints.

Q. Do not interrupt successive placement; do not permit cold joints to occur.

R. Place floor slabs as indicated on structural drawings or submit actual plan of concrete slab placement.
S. Saw cut joints within 24 hours after placing. Using 3/16 inch thick blade, cut into 1/4 depth of slab thickness.

T. Screed floors and slabs on grade level, maintaining surface flatness of maximum 1/4 inch in 10 ft.

U. Consolidation of concrete shall be done in accordance with ACI 301.

3.5 CONCRETE FINISHING

A. Provide formed concrete surfaces to be left exposed concrete walls, columns, and beams with smooth rubbed finish.

B. Finish concrete floor surfaces in accordance with ACI 301.

C. Wood float surfaces which will receive quarry tile, ceramic tile with full bed setting system.

D. Steel trowel surfaces which will receive carpeting, resilient flooring, seamless flooring, thin set quarry tile, thin set ceramic tile.

E. Steel trowel surfaces which are scheduled to be exposed.

F. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1/8 inch per foot.

G. Apply cure and seal in accordance with Section 03 37 00 - Concrete Curing.

3.6 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed in accordance with ACI 301 and under provisions of Section 01 40 00.

B. Provide free access to Work and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.

D. Tests of cement and aggregates may be performed to ensure conformance with specified requirements.

E. Three concrete test cylinders will be taken for every 50 or less cu yds of each class of concrete placed. Cylinders shall be tested on 7 day and 28 day intervals. The third cylinder shall be tested if a failure should occur and be utilized as a comparison.

F. One additional test cylinder will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.

G. One slump test and one air content test will be taken for each truck load in accordance with ASTM and ACI Standards.

3.7 PATCHING

A. If excessive honeycomb or embedded debris is present in concrete when forms are
removed, this will not acceptable. Notify Architect/Engineer upon discovery.

B. Patch imperfections in accordance with ACI 301.

3.8 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Architect/Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

3.9 SCHEDULE - CONCRETE TYPES AND FINISHES

A. Foundation Walls and Footings: 3,000 psi 28 day concrete, form finish with honeycomb filled surface.

B. Slabs on Grade: 4000 psi 28 day concrete, finish per Section 3.5.
PART 1   GENERAL

1.1 SECTION INCLUDES

A. Finishing slabs on grade.
B. Surface treatment with concrete hardener and sealer.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete: Prepared concrete slabs and toppings ready to receive finish.
B. Section 03 30 00 - Cast-in-Place Concrete: Control and formed expansion and contraction joints and joint devices.

1.3 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.

14 SUBMITTALS

A. Submit under provisions of Section 01 33 00.
B. Product Data: Provide data on finishing compounds, product characteristics, compatibility and limitations.
C. Manufacturer's Installation Instructions: Indicate criteria for preparation and application for both new and existing slabs.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products under provisions of Section 01 60 00.
B. Deliver materials in manufacturer's packaging including application instructions.

PART 2   PRODUCTS

2.1 MANUFACTURERS

A. Sonneborn
B. Master Builders.
C. Thoroseal.
D. Substitutions: Under provisions of Section 01 60 00.

2.2 COMPOUNDS - HARDENERS AND SEALERS

A. Chemical Hardener: Sonneborn - Lapidolith
3.1 EXAMINATION
A. Verify site conditions under provisions of Section 01 31 00.
B. Verify that floor surfaces are acceptable to receive the Work of this Section.

3.2 FLOOR FINISHING
A. Finish concrete floor surfaces in accordance with ACI 301.
B. Wood float surfaces which will receive quarry tile, ceramic tile, with full bed setting system.
C. Steel trowel surfaces which will receive carpeting, resilient flooring, seamless flooring thin set quarry tile thin set ceramic tile.
D. Steel trowel surfaces which are scheduled to be exposed.
E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1/8 inch per foot nominal or as indicated on Drawings.

3.3 FLOOR SURFACE TREATMENT
A. Apply liquid hardener/sealer in accordance with manufacturer's instructions on scheduled floor surfaces.
B. Finish to a polished sheen.

3.4 TOLERANCES
A. Maximum Variation of Surface Flatness for Exposed Concrete Floors: 1/8 inch in 10 ft.
B. Maximum Variation of Surface Flatness Under Seamless Resilient Flooring: 1/8 inch in 10 ft.
C. Maximum Variation of Surface Flatness Under Carpeting: 1/8 inch in 10 ft.

3.5 SCHEDULES
A. All exposed new concrete: Liquid hardener/sealer. Three coat system.
   1. First Coat: Dilute 1 Part Lapidolth to 4 parts water.
      Apply at 200 to 300 sf per gallon.
   2. Second Coat: Dilute 1 part Lapidolth to 3 parts water.
      Apply at 200 to 300 sf per gallon
   3. Third Coat: Dilute 1 part Lapidolth to 3 parts water.
      Apply at 200 to 300 sf per gallon
      a. As third coat is drying, and a uniform appearance of white crystals are is visible, flood the floor with water and buff with a commercial floor buffer using a 3M Black Pad or similar abrasive. Continue buffing until the floor acquires a patina or polish and the whiteness is gone.

END OF SECTION
PART 1   GENERAL

1.1 SECTION INCLUDES

A. Initial curing of horizontal and vertical concrete surfaces.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-In-Place Concrete.
B. Section 03 34 60 - Concrete Floor Finishing. - for exposed concrete slabs.

1.3 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.
B. ACI 302 - Recommended Practice for Concrete Floor and Slab Construction.
C. ACI 308 - Standard Practice for Curing Concrete.
D. ASTM C171 - Sheet Materials for Curing Concrete.
E. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
F. ASTM D2103 - Polyethylene Film and Sheeting.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.
B. Product Data: Provide data on curing compounds, product characteristics, compatibility and limitations.
C. Manufacturer's Installation Instructions: Indicate criteria for preparation and application.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.
B. Maintain one copy of document on site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products under provisions of Section 01 60 00.
B. Deliver curing materials in manufacturer's packaging including application instructions.

PART 2   PRODUCTS

2.1 MANUFACTURERS

A. Sonneborn
2.2 MATERIALS

A. Membrane Curing Compound: ASTM C309 Type I-D Class A or B, Acrylic type, clear without fugitive dye; equal to Kure-N-Seal WB as manufactured by Sonneborn.

B. Water: Potable and not detrimental to concrete.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify substrate conditions under provisions of Section 01 31 00.

B. Verify that substrate surfaces are ready to be cured.

3.2 EXECUTION - HORIZONTAL SURFACES

A. Cure floor surfaces in accordance with ACI 308.

B. Membrane Curing Compound: Apply curing compound in accordance with manufacturer's instructions as follows:
   1. First coat applied at rate of 200 to 400 sf/gallon.

C. Polyethylene Film: Spread polyethylene film over floor slab areas, lapping edges and sides and sealing with pressure sensitive tape; cover with plywood; maintain in place for 7 days.

3.3 EXECUTION - VERTICAL SURFACES

A. Cure surfaces in accordance with ACI 308.

B. Membrane Curing Compound: Apply curing compound in accordance with manufacturer's instructions for curing purposes.

C. Exposed concrete shall be cured and finished in accordance with Section 03 34 60.

3.4 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Section 01 50 00.

B. Do not permit traffic over unprotected floor surface.

END OF SECTION
PART 1  GENERAL

1.1  SECTION INCLUDES

A.  Architectural precast concrete sills, caps and other items indicated on drawings.
B.  Supports, anchors, and attachments.
C.  Grouting under panels.

1.2  PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A.  Section 04 81 00 - Unit Masonry Assemblies: Placement of anchors for placing in building structural components.

1.3  RELATED SECTIONS

A.  Section 03 30 00 - Cast-in-Place Concrete: Building structural frame.
B.  Section 04 81 00 - Unit Masonry Assemblies: Back-up masonry.
C.  Section 07 90 00 - Joint Sealers: Caulking of perimeter joints.

1.4  REFERENCES

A.  ANSI/ACI 301 - Specifications for Structural Concrete for Buildings.
B.  ANSI/ACI 318 - Building Code Requirements for Reinforced Concrete.
C.  ANSI/ASTM A36 - Structural Steel.
D.  ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
F.  ANSI/ASTM A386 - Zinc Coating (Hot-Dip) on Assembled Steel Products.
G.  ANSI/ASTM A416 - Uncoated Seven Wire Stress Relieved Strand for Prestressed Concrete.
H.  ANSI/ASTM A666 - Austenitic Stainless Steel, Sheet, Strip, Plate, and Flat Bar for Structural Applications
I.  ANSI/ASTM C31 - Making and Curing Concrete Test Specimens in the Field.
J.  ANSI/ASTM C143 - Test for Slump of Portland Cement Concrete.
O. ASTM A325 - High Strength Bolts for Structural Steel Joints.
P. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
Q. ASTM C33 - Concrete Aggregates.
R. PCI Manual For Structural Design of Architectural Precast Concrete.
S. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products.

1.5 DESIGN REQUIREMENTS
A. Design units to withstand design loads as calculated in accordance with IBC 2000 code, and erection forces. Calculate structural properties of units in accordance with ACI 301.
B. Design units to accommodate construction tolerances, deflection of building structural members and clearances of intended openings.
C. Design component connections to accommodate building movement and thermal movement. Provide adjustment to accommodate misalignment of structure without unit distortion or damage.

1.6 SUBMITTALS
A. Submit under provisions of Section 01 33 00.
B. Shop Drawings: Indicate layout, unit locations, configuration, unit identification marks, reinforcement, connection details, support items, location of lifting devices, dimensions, openings, and relationship to adjacent materials.
C. Samples: Submit two panels, 12 x 12 inch in size illustrating surface finish, color and texture.
D. Test shall be submitted with the shop drawings.

1.7 MAINTENANCE DATA
A. Submit under provisions of Section 01 70 00.
B. Maintenance Data: Indicate surface cleaning instructions.

18 QUALITY ASSURANCE
A. Perform Work in accordance with PCI MNL-116, and PCI MNL-123, PCI MNL120.

C. Maintain one copy of each document on site.

1.9 QUALIFICATIONS

A. Fabricator: Company specializing in performing the work of this Section with minimum ten years documented experience.

B. Design units under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Maryland.

C. Welder: Qualified within previous 12 months in accordance with ANSI/AWS D1.1 and ANSI/AWS D1.4.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.

B. Handle precast units to position, consistent with their shape and design. Lift and support only from support points.

C. Lifting or Handling Equipment: Capable of maintaining units during manufacture, storage, transportation, erection, and in position for fastening.

D. Blocking and Lateral Support During Transport and Storage: Clean, non-staining, without causing harm to exposed surfaces. Provide temporary lateral support to prevent bowing and warping.

E. Protect units to prevent staining, shipping, or spalling of concrete.

F. Mark units with date of production in location not visible to view when in final position in structure.

1.11 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on Drawings.

PART 2 PRODUCTS

2.1 MANUFACTURERS


B. Nitterhouse, Chambersburg, PA.

C. North American, McKeesport, PA.

D. Maryland Cast Stone Co., Inc., Rockville, MD.

E. Substitutions: Under provisions of Section 01 60 00.
2.2 CONCRETE MATERIALS

A. Cement: ANSI/ASTM C150, Portland Type I - Normal; colors shall be used to meet the Owner and Architects requirements.
   1. All colors added to the concrete shall be durable, non-facing mineral oxides

B. Concrete Materials: ASTM C33; water and sand.

C. Reinforcing Steel: ASTM A615, deformed steel bars ANSI/ASTM A185, welded steel wire fabric; epoxy finish, strength and size commensurate with precast unit design.


E. Surface Finish Aggregate: Precast shall be made by the monolithic poured process. Texture shall be as selected by the Owner and Architect.

F. Grout: Non-shrink, minimum 10,000 psi, 28 day strength.

G. Water Absorption: Not greater than 5% when tested in accordance with ACI Specifications.

2.3 SUPPORT DEVICES


C. Primer: Zinc rich oil alkyd.

2.4 ACCESSORIES

A. Sealant: type specified in Section 07 90 00.

2.5 MIX

A. Concrete: Minimum 5000 psi, 28 day strength, air entrained to 5 to 7 percent in accordance with ANSI/ACI 301.

2.6 FABRICATION

A. Fabrication procedure to conform to PCI MNL-117.

B. Maintain plant records and quality control program during production of precast units. Make records available upon request.

C. Use rigid molds, constructed to maintain precast unit uniform in shape, size and finish.

D. Maintain consistent quality during manufacture.

E. Fabricate connecting devices, plates, angles, inserts, bolts, and accessories. Fabricate to permit initial placement and final attachment.
F. Embed reinforcing steel, anchors, inserts plates, angles, and other cast-in items as indicated on Shop Drawings.

G. Locate hoisting devices to permit removal after erection.

H. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

I. Minor patching in plant is not acceptable.

2.7 FINISH - PRECAST UNITS

A. Finish Type A: Ensure exposed-to-view finish surfaces of precast units are uniform in color and appearance. All units shall be true and uniform, without blemishes, honeycombs and imperfections.

2.8 FINISH - SUPPORT DEVICES

A. Clean surfaces of rust, scale, grease, and foreign matter.

B. Prime paint in two coats, except surfaces in direct contact with concrete or requiring field welding.

2.9 FABRICATION TOLERANCES

A. Maximum Out of Square: 1/8 inch in 10 feet, non-cumulative.

B. Variation From Dimensions Indicated on Shop Drawings: Plus or minus 1/8 inch.

C. Maximum Misalignment of Anchors, Inserts, Openings: 1/8 inch.

D. Maximum Bowing of Units: Length of bow/360.

2.10 SOURCE QUALITY CONTROL AND TESTS

A. Provide testing and analysis of concrete mix under provisions of Section 01 40 00.

B. Take 3 concrete test cylinders for every 10 cu yds of concrete placed in accordance with ANSI/ASTM C31.

C. Take 1 slump tests for every test cylinders in accordance with ANSI/ASTM C143.

D. Take one air entrainment test cylinders for each set of exterior concrete test cylinders taken.

E. Take water absorption test in accordance with PCI MNL-117.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions under provisions of Section 01 31 00.
B. Verify that building structure, anchors, devices, and openings are ready to receive work of this Section.

3.2 PREPARATION

A. Provide for erection procedures and induced loads during erection. Maintain temporary bracing in place until final support is provided.

B. Provide necessary hoisting equipment.

3.3 CLEANING AND PROTECTION

A. Packaging/Shipping materials (i.e. Strapping, felt and plastic) must be removed from contact with stone face upon receipt.

B. Face of all stone shall be cleaned down at completion using mild soap powder applied vigorously with stiff fiber brushes and clean water. After cleaning, rinse thoroughly with clean water. DO NOT use cleaning materials (acid) or processes (high-pressured wash down equipment) which would change the character of exposed concrete finishes.

C. All stones shall be stored off the ground, properly covered immediately upon arrival at the job site by the General Contractor, and it shall remain his responsibility to maintain such protections until job is complete. Any moisture (ground moisture leaching under the protective cover) can cause staining. As stone cures, if any material is in contact with the face of the stone, a stain could occur.

3.4 ERECTION

A. Erect units without damage to shape or finish. Replace or repair damaged panels.

B. Erect units level and plumb within allowable tolerances.

C. Align and maintain uniform horizontal and vertical joints as erection progresses.

D. When units require adjustment beyond design or tolerance criteria, discontinue affected work; advise Architect/Engineer.

E. Fasten units in place. Perform welding when required in accordance with ANSI/AWS D1.1.

F. Touch-up field welds and scratched or damaged primed painted surfaces.

G. Set vertical units dry, without grout, attaining joint dimension with lead or plastic spacers. Pack grout to base of unit.

H. Exposed Joint Dimension: 1/2 inch.

3.4 ERECTION TOLERANCES

A. Maximum Variation from Plane of Location: 1/4 inch in 10 feet and 3/8 inch in 100 feet, non-cumulative.

B. Maximum Offset from True Alignment between Two Connecting Units: 1/4 inch.
C. Joint Tolerance: Plus or minus 1/4 inch.

3.5 ADJUSTING

A. Adjust work under provisions of Section 01 73 00.

B. Adjust units so that joint dimensions are within tolerances.

3.6 PROTECTION

A. Protect units from damage.

B. Provide non-combustible shields during welding operations.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A.   Section includes mortar and grout for masonry.

B.   Related Sections:
1.   Section 04 81 00 - Unit Masonry Assemblies: Installation of mortar and grout.
2.   Section 08 11 00 - Steel Doors and Frames: Grouting steel door frames.

1.2 REFERENCES

A.   American Concrete Institute:
1.   ACI 530 - Building Code Requirements for Masonry Structures.
2.   ACI 530.1 - Specifications for Masonry Structures.

B.   ASTM International:

1.3 SUBMITTALS

A.   Section 01 33 00 - Submittal Procedures: Submittal requirements.

B.   Samples: Submit two samples of mortar, illustrating mortar color and color range.
C. Design Data: Submit design mix when Property specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.

D. Test Reports:
   1. Submit reports on mortar indicating conformance of mortar to property requirements of ASTM C270 and test and evaluation reports to ASTM C780 for aggregate ratio and water content, air content, consistency and compressive strength.
   2. Submit reports on grout indicating conformance of grout to property requirements of ASTM C476 and test and evaluation reports to ASTM C1019.

E. Manufacturer's Installation Instructions: Submit premix mortar manufacturer's installation instructions.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 530 and ACI 530.1.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.

C. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

PART 2 PRODUCTS

2.1 MORTAR AND MASONRY GROUT

A. Manufacturers:
   1. Argos
   2. Essroc
   3. Riverton, Product Flamingo
   4. Substitutions: Section 01 60 00 - Product Requirements.

2.2 COMPONENTS

A. Mortar Cement: ASTM C1329, Types S.

B. Mortar Aggregate: ASTM C144, standard masonry type.

C. Grout Aggregate: ASTM C404, fine.

D. Water: Clean and potable.

E. Mortar Color: Sahara.
2.3 MIXES

A. Mortar Mixes:

B. Mortar Mixing:
   1. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
   2. Achieve uniformly damp sand immediately before mixing process.
   3. Add mortar color and admixtures to achieve uniformity of mix and coloration.
   4. Re-temper only within two hours of mixing.

C. Grout Mixes:
   1. Grout for Non-Structural Masonry: 2,000 psi strength at 28 days; 8-11 inches slump; mixed in accordance with ASTM C476 Fine or Course grout.
   2. Grout for Structural Masonry: 2,000 psi strength at 28 days; 8-11 inches slump; mixed in accordance with ASTM C476 Fine or Course grout.
   3. Application:
      a. Coarse Grout: For grouting spaces with minimum 4 inches dimension in every direction.
      b. Fine Grout: For grouting other spaces.

D. Grout Mixing:
   1. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476.
   2. Add admixtures; mix uniformly.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 - Administrative Requirements: Coordination and project conditions.
B. Request inspection of spaces to be grouted.

3.2 PREPARATION

A. Apply bonding agent to existing concrete surfaces.

3.3 INSTALLATION

A. Install mortar and grout in accordance with ACI 530.1 Specifications for Masonry Structures.
3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Testing Frequency: One set of specified tests for every 5,000 sf of completed wall area.

C. Testing of Mortar Mix: In accordance with ASTM C780 for aggregate ratio and water content, air content, consistency, and compressive strength.

D. Testing of Grout Mix: In accordance with ASTM C1019 for compressive strength, and in accordance with ASTM C143/C143M for slump.

E. Test flexural bond strength of mortar and masonry units to ASTM C1357; test in conjunction with masonry unit sections specified.

F. Test compressive strength of mortar and masonry to ASTM C1314; test in accordance with masonry unit sections specified.

3.5 SCHEDULES

A. Exterior Cavity Wall: Brick masonry with Type S mortar with Type N pointing mortar.

B. Interior Masonry Walls: Type S mortar.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section includes brick and concrete masonry units; pre-faced brick concrete masonry units; reinforcement, anchorage, and accessories; and parged masonry surfaces.

B. Related Sections:
1. Section 04 10 00 - Masonry Mortar and Grout: Mortar and grout.
2. Section 05 12 00 - Structural Steel: Product requirements for steel anchors for placement by this section.
3. Section 05 21 00 - Steel Joists: Product requirements for steel bearing pads for joists for placement by this section.
4. Section 05 50 00 - Metal Fabrications: Product requirements for loose steel lintels and fabricated steel items for placement by this section.
5. Section 07 27 26 - Fluid Applied Membrane Air Barriers.
6. Section 07 21 00 - Thermal Insulation: Insulation for cavity spaces.
7. Section 07 84 00 - Firestopping: Firestopping at penetrations of masonry work.
8. Section 07 90 00 - Joint Sealers: Rod and sealant at control and expansion joints.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 530 - Building Code Requirements for Masonry Structures.
2. ACI 530.1 - Specifications for Masonry Structures.

B. ASTM International:
1. ASTM A153/A153M - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
4. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
5. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
12. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.
13. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units.
14. ASTM C140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units.
15. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).

C. National Fire Protection Association:

D. Underwriters Laboratories Inc.:

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Product Data:
   1. Submit data for concrete masonry units and fabricated wire reinforcement, wall ties, anchors, and other accessories.
   2. Indicate initial rate of absorption for face brick.

C. Samples: Submit four samples of face brick, units to illustrate color, texture and extremes of color range.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 530 Building Code Requirements for Masonry Structures and ACI 530.1 Specification for Masonry Structures.

B. Fire Rated Wall Construction: Rating as indicated on Drawings.
   1. Tested Rating: Determined in accordance with ASTM E119.

C. Surface Burning Characteristics:
   1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

D. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation insert.
1.5 QUALIFICATIONS
A. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 MOCKUP
A. Section 01 40 00 - Quality Requirements: Mockup requirements.
B. Construct composite cavity masonry wall mockup, 4 feet long by 4 feet high, including masonry, mortar and accessories, structural backup, flashings, wall insulation, air and vapor membrane, parging, and, mortar net with weeps.
C. Locate where directed by Architect/Engineer.
D. Remove mockup when directed by Architect/Engineer.

1.7 PRE-INSTALLATION MEETINGS
A. Section 01 31 00 - Administrative Requirements: Pre-installation meeting.
B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING
A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
B. Accept pre-faced units on site. Inspect for damage.

1.9 ENVIRONMENTAL REQUIREMENTS
A. Section 01 60 00 - Product Requirements.
B. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.
C. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

1.10 COORDINATION
A. Section 01 31 00 - Administrative Requirements: Coordination and project conditions.
B. Coordinate masonry work with installation of window and door anchors.

1.11 EXTRA MATERIALS
A. Section 01 73 00 - Execution Requirements: Spare parts and maintenance products.
B. Supply 20 of each size, color, and type of pre-faced units.
PART 2 PRODUCTS

2.1 UNIT MASONRY

A. Facing Brick Manufacturers:
   1. Redland Brick Inc. – Cushwa Plant (Basis of Design)
   2. Substitutions: Section 01 60 00 - Product Requirements.

2.2 COMPONENTS

A. Facing Brick: ASTM C216, Type FBS, Grade SW.
   1. Field Color: Match existing.
B. Building Brick: ASTM C62, Grade SW; solid units.
C. Hollow Brick: ASTM C652, Grade SW.
D. Brick Size and Shape: Nominal size of 4 x 4 x 12 inches. Furnish special units for 90 degree corners, and lintels.
E. Special Brick Shape: Shaped to profile indicated; surface texture on four sides and ends.
F. Hollow Load Bearing Concrete Masonry Units (CMU): ASTM C90; normal weight.
G. Solid Load-Bearing Concrete Masonry Units (CMU): ASTM C90; normal weight.
H. Hollow Non-Load Bearing Concrete Masonry Units (CMU): ASTM C129 light weight.
I. Concrete Brick Units: ASTM C55, Grade S; same weight as block units.
J. Concrete Masonry Unit Size and Shape: Nominal modular size of 8 x 8 x 16 inches. Furnish special units for 90 degree corners, bond beams, lintels, and bullnosed corners.

2.3 ACCESSORIES

A. Single Wythe Joint Reinforcement: ASTM A951; truss type; steel; 0.188 inch diameter side rods with 0.148 inch diameter cross ties; hot dip galvanized.
B. Multiple Wythe Joint Reinforcement: ASTM A951; truss type; steel; with moisture drip; adjustable type; 0.188 inch diameter side rods with 0.148 inch diameter cross ties; hot dip galvanized.
C. Reinforcing Steel: ASTM A615/A615M, 60 ksi yield grade, deformed billet bars, uncoated finish.
D. Strap Anchors: bent steel shape, 1 1/2 x 24 inch size x 1/4 inch thick; ASTM A153/ A153M hot dip galvanized.
E. Wall Ties (CMU): Corrugated formed sheet metal, 7/8 x 7 inch size x 16 gage thick; ASTM A153/A153M hot dip galvanized.
F. Wall Ties (Metal Stud): ASTM A82; steel wire 3/16 inch diameter, adjustable; ASTM A153/A153M hot dip galvanized, designed to span specified cavity.

G. Anchor Rods: ASTM A307; Grade C; J-shaped or L-shaped; complete with washers and heavy hex nuts; sized for minimum 15 inch embedment; galvanized finish.
   1. Hot-Dipped Galvanizing: ASTM A153/A153M.

H. Mortar and Grout: As specified in Section 04 10 00.

I. Copper/Kraft Paper Flashings: Equal to York Manufacturing 5 oz. CDA alloy cooper sheet with 060 temper conforming to ASTM B-370-98 bonded between two layers of fabric weighing not less than 0.3oz/ft² with a minimum of 20 x 10 threads per inch.

J. Stainless Steel Drip Edge Flashing: ASTM A240, Type 304; 26 gage x 1 ½” wide with 3/8” hemmed edge.

K. Preformed Control Joints: Polyvinyl chloride material. Furnish with corner and tee accessories, heat fused joints.

L. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; 3/8 inch wide x by maximum lengths.

M. Cavity Drain Material (Mortar Net): Open polyethylene dovetail mesh thickness required to fill cavity space, and shaped to ensure moisture drainage to cavity weeps.
   1. Advanced Building Products, Inc.
   2. CavClear/Archovations Inc.
   3. Mortar Net USA, Ltd.
   4. Dur-O-Wall, Inc.
   5. Substitutions: Section 01600 - Product Requirements.

N. Building Paper: ASTM D226; Type I, No. 15 unperforated asphalt felt.

O. Nailing Strips: Softwood, preservative treated for moisture resistance, dovetail shape, sized to masonry joints.

P. Weeps: Equal to Blok-Lok Cellvent fabricated from flexible polypropylene-colpolymer fastic. Color as selected.

Q. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

R. Precast Concrete Lintels: Type, size, as indicated on Drawings 3,000 psi strength at 28 days.

S. Steel Lintels: size as indicated on Drawings, hot-dip galvanized.

2.4 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.
B. Test brick efflorescence in accordance with ASTM C67. Brick rated greater than “slightly effloresced” is not acceptable.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 - Administrative Requirements: coordination and project conditions.
B. Verify field conditions are acceptable and are ready to receive work.
C. Verify items provided by other sections of work are properly sized and located.
D. Verify built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied to other sections.
B. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.
C. Wet clay and shale brick before laying when initial rate of absorption is greater than 30 grams when tested in accordance with ASTM C67.

3.3 INSTALLATION

A. Establish lines, levels, and coursing indicated. Protect from displacement.
B. Maintain masonry courses to uniform dimension. Form bed and head joints of uniform thickness.
C. Coursing of Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.
D. Coursing of Brick Units:
   1. Bond: Running. To match existing.
   2. Coursing: Three units and three mortar joints to equal 8 inches.
E. Placing And Bonding:
   1. Lay solid masonry units in full bed of mortar, with full head joints.
   2. Lay hollow masonry units with face shell bedding on head and bed joints.
   3. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
   4. Remove excess mortar as work progresses.
   5. Interlock intersections and external corners.
   6. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is required, remove mortar and replace.
7. Perform job site cutting of masonry units with proper tools to assure straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
8. Cut mortar joints flush where wall tile is scheduled, cement parging is required, resilient base is scheduled, cavity insulation vapor retarder adhesive is applied, or bitumen dampproofing is applied.
9. Isolate masonry from vertical structural framing members with movement joint using ½ inch polystrene insulation or expansion joint mortar.
10. Isolate top of masonry from horizontal structural framing members and slabs or decks with compressible joint filler.

F. Weeps and Vents: Furnish weeps and vents in outer wythe at 24 inches oc horizontally above through-wall flashing, above shelf angles and lintels, and at bottom and top of walls.

G. Cavity Wall: Do not permit mortar to drop or accumulate into cavity air space or to plug weeps. Build inner wythe ahead of outer wythe to receive cavity insulation and air/vapor retarder adhesive.
   1. Install cavity drain material continuously at bottom of each cavity above through wall flashing and at all flashing locations.

H. Joint Reinforcement and Anchorage - Single Wythe Masonry:
   1. Install horizontal joint reinforcement 16 inches oc.
   2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
   3. Place joint reinforcement continuous in first [and second] joint below top of walls.
   4. Lap joint reinforcement ends minimum 6 inches.
   5. Reinforce joint corners and intersections with strap anchors 16 inches oc.

I. Joint Reinforcement and Anchorage - Masonry Veneer:
   1. Install horizontal joint reinforcement 16 inches oc.
   2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
   3. Place joint reinforcement continuous in first [and second] joint below top of walls.
   4. Lap joint reinforcement ends minimum 6 inches.
   5. Embed wall ties in masonry backing to bond veneer at maximum 16 inches oc vertically and 16 inches oc horizontally. Place wall ties at maximum 8 inches oc vertically within 8 inches of jamb of wall openings.

J. Joint Reinforcement and Anchorages - Cavity Wall Masonry:
   1. Install horizontal joint reinforcement 16 inches oc.
   2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
   3. Place joint reinforcement continuous in first [and second] joint below top of walls.
   4. Lap joint reinforcement ends minimum 6 inches.
   5. Attach to structural steel members. Embed anchorages in every second block, sixth brick joint.
6. Reinforce joint corners and intersections with strap anchors 16 inches oc.

K. Reinforcement and Anchorages - Multiple Wythe Unit Masonry:
   1. Install horizontal joint reinforcement 16 inches oc.
   2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
   3. Place joint reinforcement continuous in first [and second] joint below top of walls.
   4. Lap joint reinforcement ends minimum 6 inches.
   5. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
   6. Embed anchors attached to structural steel members. Embed anchorages in every second block, sixth brick joint.
   7. Reinforce [stack bonded unit] joint corners and intersections with strap anchors 16 inches oc.

L. Masonry Flashings:
   1. Extend flashings horizontally on top of drip edge flashing through outer wythe at foundation walls, above ledge or shelf angles and lintels, under parapet caps, at bottom of walls, and trim flush with mortar joint.
   2. Turn flashing up minimum 8 inches and bed into mortar joint of masonry, seal to concrete, seal to sheathing over wood or steel stud framed backing.
   3. Lap end joints minimum 6 inches and seal watertight using manufacturers recommended adhesive and sealer.
   4. Turn flashing, fold, and seal at corners, bends, and interruptions.

M. Lintels:
   1. Install loose steel or precast concrete lintels over openings sized per structural drawings.
   2. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled or indicated.
   3. Do not splice reinforcing bars.
   4. Support and secure reinforcing bars from displacement.
   5. Place and consolidate grout fill without displacing reinforcing.
   6. Allow masonry lintels to attain specified strength before removing temporary supports.
   7. Maintain minimum 8 inch bearing on each side of opening.

N. Grouted Components:
   1. Reinforce bond beam as indicated on structural drawings.
   2. Lap splices bar diameters required by code.
   3. Support and secure reinforcing bars from displacement.
   4. Place and consolidate grout fill without displacing reinforcing.
   5. At bearing locations, fill masonry cores with grout for minimum 12 inches both sides of opening.

O. Reinforced Masonry:
   1. Lay masonry units with cells vertically aligned and [cavities between wythes] clear of mortar and unobstructed.
   2. Place reinforcement bars as indicated on Drawings.
   3. Splice reinforcement in accordance with Section 03 20 00.
   4. Support and secure reinforcement from displacement.
   5. Place and consolidate grout fill without displacing reinforcing.
6. Place grout in accordance with ACI 530.1 Specification for Masonry Structures.

P. Control and Expansion Joints:
   1. Install control [and expansion] joints at the following maximum spacings, unless otherwise indicated on Drawings:
      a. Exterior Walls: 20 feet on center and within 24 inches on one side of each interior and exterior corner.
      b. Interior Walls: 30 feet on center.
      c. At changes in wall height.
   2. Do not continue horizontal joint reinforcement through control and expansion joints.
   3. Form control joint with sheet building paper bond breaker fitted to one side of hollow contour end of block unit. Fill resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
   4. Size control joint in accordance with Section 07900 for sealant performance.
   5. Form expansion joint by omitting mortar and cutting unit to form open space.

Q. Built-In Work:
   1. As work progresses, install built-in metal door and glazed frames, fabricated metal frames, window frames, wood nailing strips, anchor bolts, plates, and other items to be built-in the work and furnished by other sections.
   2. Install built-in items plumb and level.
   3. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout or mortar. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
   4. Do not build in materials subject to deterioration.

R. Cutting And Fitting:
   1. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.
   2. Obtain Architect/Engineer’s approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

S. Parging:
   1. Dampen masonry walls prior to parging.
   2. Scarify each parging coat to ensure full bond to subsequent coat.
   3. Parge masonry walls in two uniform coats of mortar to total thickness of 3/4 inch.
   4. Steel trowel surface smooth and flat with maximum surface variation of 1/8 inch per foot.
   5. Strike top edge of parging at 45 degrees.

3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Alignment of Columns: 1/4 inch.

C. Maximum Variation from Unit to Adjacent Unit: 1/32 inch.
D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

E. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

F. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

G. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

H. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

I. Maximum Variation for Steel Reinforcement:
   1. Install reinforcement within the tolerances specified in ACI 530.1 for foundation walls.
   2. Plus or minus 1/2 inch when distance from centerline of steel to opposite face of masonry is 8 inches or less.
   3. Plus or minus 1 inch when distance is between 8 and 24 inches.
   4. Plus or minus 1-1/4 inch when distance is greater than 24 inches.
   5. Plus or minus 2 inches from location along face of wall.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Brick Units: Test each type in accordance with ASTM C67, 5 random units for each 50,000 units installed.

C. Concrete Masonry Units: Test each type in accordance with ASTM C140.

3.6 CLEANING

A. Section 01 73 00 - Execution Requirements: Final cleaning.

B. Remove excess mortar and mortar smears as work progresses.

C. Replace defective mortar. Match adjacent work.

D. Clean soiled surfaces with cleaning solution.

E. Use non-metallic tools in cleaning operations.

3.7 PROTECTION OF FINISHED WORK

A. Section 01 50 00 – Construction Facilities and Temporary Controls: Requirements for protecting finished Work.

B. Protect exposed external corners subject to damage.

C. Protect base of walls from mud and mortar splatter.
D. Protect masonry and other items built into masonry walls from mortar droppings and staining caused by mortar.

E. Protect tops of masonry work with waterproof coverings secured in place without damaging masonry. Provide coverings where masonry is exposed to weather when work is not in progress.

3.8 SCHEDULES

A. Exterior Wall: Composite masonry with exterior wythe of face brick veneer, bonded with wire ladder reinforcement to inner wythe of interior concrete block masonry (CMU) with 2 inch space for insulation. Air and vapor barrier membrane per Section 07 27 26.

B. Interior Partitions: Single wythe concrete masonry units.

C. Interior Fire Rated Walls: One and two hour walls of grout filled concrete masonry with locations identified on Drawings.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Structural steel framing members, columns, beams, purlings, bracing, support members, welds and fasteners.
B. Baseplates.
C. Column Anchors.
D. Grouting under baseplates.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 03 30 00 - Cast-In-Place Concrete: Anchors for casting into concrete.
B. Section 04 30 00 - Unit Masonry System: Anchors for embedding into masonry.

1.3 RELATED SECTIONS

A. Section 05 21 00 - Steel Joists.
B. Section 05 31 10 - Steel Roof Deck: Support framing for small openings in roof deck.
C. Section 05 31 30 - Steel Floor Deck: Support framing for small openings in floor deck.
D. Section 05 50 00 - Metal Fabrications: Non-framing fabrications affecting structural steel work.
E. Section 09 90 00 - Painting: Finish painting.

1.4 REFERENCES

A. ASTM A36 - Structural Steel.
B. ASTM A53 - Welded and Seamless Steel Pipe.
C. ASTM A325 - High Strength Bolts for Structural Steel Joints.
D. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
E. AWS D1.1 - Structural Welding Code.
G. AISC - Specification for Architectural Exposed Structural Steel.
H. SSPC - Steel Structures Painting Council.
I. AISI - American Iron and Steel Institute
J. LGSI - Light Gage Steel Institute

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings:
   1. Indicate profiles, sizes, spacing, and locations of structural members, openings, attachments and fasteners.
   2. Connections.

C. Manufacturer's Mill Certificate: Submit under provisions of Section 01 33 00 certifying that products meet or exceed specified requirements.

D. Welders' Certificates: Submit under provisions of Section 01 33 00 Manufacturer's Certificates, certifying welders employed on the Work, verifying AWS qualifications within the previous 12 months.

16 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

B. Perform Work in accordance with AISC - Specification for Architectural Exposed Structural Steel.

C. Maintain one copy of document on site.

1.7 QUALIFICATIONS

A. Fabricator: Company specializing in performing the work of this Section with minimum ten (10) years documented experience.

B. Erector: Company specializing in performing the work of this Section with minimum five (5) years documented experience.

1.8 FIELD MEASUREMENTS

A. Verify that field measurements are as shown on shop drawings.

PART 2 PRODUCTS

2.1 MATERIALS

A. Structural Steel Members: ASTM A36.

B. Structural Tubing: ASTM A500, Grade B.

C. Pipe: ASTM A53, Grade B.


F. Welding Materials: AWS D1.1; type required for materials being welded.

G. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 28 days; manufactured by Independent Cement or Lehigh Valley.

H. Masonry Column Anchors: equal to Dur-O-Wall's D/A 710 mounted continuous to flange of column by welding in accordance with the manufacturer's recommendations. Coordinate with ties specified in Section 04300.

I. Shop and Touch-Up Primer: SSPC Paint 15, Type 1, red oxide.

J. Touch-up Primer for Galvanized Surfaces: Zinc rich type.

2.2 FABRICATION

A. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

2.3 FINISH

A. Prepare structural component surfaces in accordance with SSPC SP-2.

B. Shop prime structural steel members. Do not prime surfaces that will be in contact with concrete.

2.4 SOURCE QUALITY CONTROL AND TESTS

A. Testing and analysis of components will be performed under provisions of Section 01 40 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Beginning of installation means erector accepts existing conditions.

3.2 ERECTION

A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

B. Field weld components indicated on Drawings.

C. Do not field cut or alter structural members without approval of Architect/Engineer.
D. After erection, clean, wire brush and prime welds, abrasions, and surfaces not shop
primed, except surfaces to be in contact with concrete.
E. Contractor shall provide full, 100 percent grouting under baseplates.

3.3 ERECTION TOLERANCES
A. Maximum Variation from Plumb: 1/4 inch per story, non-cumulative.
B. Maximum Offset from True Alignment: 1/4 inch.

3.4 FIELD QUALITY CONTROL
A. Field inspection will be performed under provisions of Section 01 40 00.
B. Provide inspections and reports in accordance with IBC 2000 - Table 1704.3.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Open web steel joists, with bridging, attached seats, and anchors.
B. Loose bearing plates and anchor bolts for site placement.
C. Framed roof openings greater than 18 inches.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 03 30 00 - Cast-In-Place Concrete: Anchors for casting into concrete.
B. Section 04 81 00 - Unit Masonry Assemblies: Anchors for embedding into masonry.

1.3 RELATED SECTIONS

A. Section 04 10 00 - Mortar: Grouting base plates and bearing plates.
B. Section 05 12 00 - Structural Steel.
C. Section 05 31 10 - Steel Roof Deck: Support framing for small openings in roof deck.
D. Section 05 50 00 - Metal Fabrications: Non-framing steel fabrications.
E. Section 09 90 00 - Painting.

1.4 REFERENCES

A. ASTM A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality.
C. ASTM A325 - High Strength Bolts for Structural Steel Joints.
D. AWS D1.1 - Structural Welding Code.
E. FS TT-P-636 - Primer Coating, Alkyd, Wood and Ferrous Metal.
F. SJI - Standard Specifications for Open Web Steel Joists K and LH Series.
G. SSPC - Steel Structures Painting Council.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.
B. Shop Drawings:
   1. Indicate standard designations, configuration, sizes, spacing, locations of joists, and joist leg extensions.
   2. Joist coding, bridging, connections, and attachments.
   3. Cambers and finish.
C. Welders' Certificates: Submit manufacturer's certificates under provisions of Section 01 33 00 that welders employed on the Work have met AWS qualification within the previous 12 months.

D. Certification: In accordance with IBC 2015, Article 2206.5, submit a Certificate of Compliance stating that work was performed with approved construction documents and with SJI standard specifications to the Owner, Architect, Structural Engineer and Building Permit Authority.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with SJI Standard Specifications, Load Tables, and Weight Tables, including headers and other supplementary framing.

B. Maintain one (1) copy of each document on site.

1.7 QUALIFICATIONS

A. Fabricator: Company specializing in performing the work of this Section with minimum ten (10) years documented experience.

B. Erector: Company specializing in performing the work of this Section with minimum five (5) years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 01 60 00 and to SJI requirements.

B. Store and protect products under provisions of Section 01 60 00 and to SJI requirements.

C. Protect joists from distortion or damage.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as shown on Drawings and shop drawings.

PART 2 PRODUCTS

2.1 MATERIALS

A. Open Web Joists Members: SJI Type K & Type LH open web.


C. Primer: PPG Water Base Inhibitive metal primer 6-712 at 4.8 mils MWF.

D. Structural Steel for Supplementary Framing and Joist Leg Extensions: ASTM A36.

E. Welding Materials: AWS D1.1; type required for materials being welded.

2.2 FABRICATION

A. Provide bottom and top chord extensions as indicated on drawings.

B. Frame special sized openings in joist chord framing as detailed.
2.3 FINISH
   A. Shop prime joists. Do not prime surfaces that will be field welded or in contact with concrete.

2.4 SOURCE QUALITY CONTROL
   A. Testing and analysis of components will be performed under provisions of Section 01 40 00.

PART 3 EXECUTION

3.1 EXAMINATION
   A. Verify that field conditions are acceptable and are ready to receive work.
   B. Beginning of installation means erector accepts existing conditions.

3.2 ERECTION
   A. Erect and bear joists on supports.
   B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment until completion of erection and installation of permanent bridging and bracing.
   C. Coordinate placement of anchors in concrete or masonry construction for securing bearing plates and angles.
   D. After joist alignment and installation of framing, field weld joist seat to bearing plates and angles.
   E. Position and field weld joist chord extensions and wall attachments as detailed.
   F. Frame floor and roof openings greater than 18 inches with supplementary framing.
   G. Do not permit erection of decking until joists are braced, bridged, and secured.
   H. Do not field cut or alter structural members without approval of joist fabricator and Architect/Engineer.
   I. After erection, clean, brush and prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.3 ERECTION TOLERANCES
   A. Maximum Variation from Plumb: 1/4 inch.
   B. Maximum Offset from True Alignment: 1/4 inch.

3.4 FIELD QUALITY CONTROL
   A. Field inspection will be performed under provisions of Section 01 40 00.

END OF SECTION
PART 1  GENERAL

1.1  SECTION INCLUDES

A. Steel roof deck and accessories with sound absorbing batts.
B. Framing for openings up to and including 18 inches
C. Bearing plates and angles.

1.2  PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 03 30 00 - Cast-In-Place Concrete: Installation of anchors for bearing plates and angles cast in concrete.
B. Section 04 30 00 - Unit Masonry System: Installation of anchors for bearing plates and angles embedded in masonry.

1.3  RELATED SECTIONS

A. Section 05 12 00 - Structural Steel: Structural framed openings larger than 12 inches.
B. Section 05 21 00 - Steel Joists: Structural framed openings larger than 12 inches.

1.4  REFERENCES

A. AISI - Specification for the Design of Cold-Formed Steel Structural Members.
B. ASTM A36 - Structural Steel.
C. ASTM A446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
D. ASTM A611 - Steel, Cold-Rolled Sheet, Carbon, Structural.
E. AWS D1.1 - Structural Welding Code.
F. SDI - Design Manual for Composite Decks, Form Decks, Roof Decks.

1.5  PERFORMANCE REQUIREMENTS

A. Design metal decking in accordance with SDI Design Manual for Composite Decks, Form Decks, Roof Decks.
B. Calculate to structural limit stress design and maximum vertical deck deflection of 1/240.
C. Lateral deflection of diaphragm shall not exceed 1/500 of the story height.

1.6  SUBMITTALS

A. Submit under provisions of Section 01 33 00.
B. Shop Drawings: Indicate decking plan, support locations, projections, openings and reinforcement, pertinent details, and accessories. Indicate temporary shoring of decking where required.
C. Product Data: Provide deck profile characteristics and dimensions, structural
properties, and finishes.

D. Manufacturer's Installation Instructions: Indicate specific installation sequence, and special instructions.

1.7 QUALIFICATIONS

A. Installer: Company specializing in performing the work of this Section with minimum five (5) years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 01 60 00.
B. Store and protect products under provisions of Section 01 60 00.
C. Cut plastic wrap to encourage ventilation.
D. Separate sheets and store decking on dry wood sleepers; slope for positive drainage.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as shown on Drawings and confirmed by shop drawings.

PART 2 PRODUCTS

2.1 MATERIALS

A. Sheet Steel: ASTM A611, Grade B Structural Quality; with G60 galvanized coating conforming to ASTM A446.
B. Sheet Steel: ASTM A611, Grade C, galvanized.
C. Bearing Plates and Angles: ASTM A36 steel, unfinished.
E. Touch-Up Primer: Zinc chromate type.

2.2 ACCESSORIES

A. Flute Closures: Closed cell foam rubber, one (1) inch thick; profiled to fit tight to the decking.
B. Sound Absorbing Batts: Inert, inorganic mineral fibered material.

2.3 FABRICATION

A. Metal Decking: Sheet steel, configured as follows:
   - Span Design: Multiple
   - Minimum Metal Thickness (Excluding Finish): 22 gage
   - Nominal Height: 1-1/2 inch, fluted profile to SDI WR
   - Formed Sheet Width: 36 inch
   - Side Joints: Lock seam
   - Flute Sides: Plain vertical face
   - Finish: Galvanized
B. Fabricate roof sump pump pan of 14 gage sheet steel, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, sealed watertight.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.
B. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

A. Erect metal decking in accordance with SDI Design Manual for Composite Decks, Form Decks, Roof Decks.
B. Bear decking on masonry or concrete support surfaces with 4 inch minimum bearing. Align and level.
C. Bear decking on steel supports with 1-1/2 inch minimum bearing. Align and level.
D. Fasten deck to steel support members at ends and intermediate supports with 3/4" puddle welds (through weld washers if 24 ga. or thinner) at 12 inches oc maximum, parallel with the deck flute and at every other transverse flute.
E. Weld in accordance with AWS D1.1.
F. Mechanically clinch male/female side laps at 24 inches oc maximum.
G. Reinforce steel deck openings from 6 to 24 inches in size with 2 1/2 x 2 1/2 x 3/16 inch steel angles. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and puddle weld to deck at each flute. Openings larger than 24" to 48" shall be reinforced with 4 x 3 x 1/4" steel angle framed to structure.
H. Install 6 inch minimum wide sheet steel cover plates, of same thickness as decking, where deck changes direction. Puddle weld 12 inches oc maximum.
I. Install sheet steel closures and angle flashings to close openings between deck and walls, columns, and openings.
J. Install single row of foam flute closures above walls and partitions perpendicular to deck flutes.
K. Position roof sump pans with flange bearing on top surface of deck. Puddle weld at each deck flute.
L. Immediately after welding deck and other metal components in position, clean, wire brush and coat welds, burned areas, and damaged surface coating, with touch-up prime paint.
M. Prior to start of roofing membrane, install sound absorbing batts. Protect as required to avoid damage from environmental elements.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Steel floor deck and accessories.
B. Formed steel deck end forms to contain wet concrete.
C. Framing for openings up to and including 18 inches.
D. Bearing plates and angles.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 03 30 00 - Cast-In-Place Concrete: Installation of anchors for bearing plates and angles cast in concrete.
B. Section 04 30 00 - Unit Masonry System: Installation of anchors for bearing plates and angles embedded in masonry.

1.3 RELATED SECTIONS

A. Section 03 20 00 - Concrete Reinforcement.
B. Section 03 30 00 - Cast-in-Place Concrete: Concrete topping over metal floor deck.
C. Section 05 12 00 - Structural Steel: Structural framed openings larger than 12 inches.
D. Section 05 21 00 - Steel Joists: Structural framed openings larger than 12 inches.
E. Section 05 31 00 - Steel Roof Deck.

1.4 REFERENCES

A. AISI - Specification for the Design of Cold-Formed Steel Structural Members.
B. ASTM A36 - Structural Steel.
C. ASTM A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality.
D. ASTM A446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
E. ASTM A525 - Steel Sheet, Zinc-Coated, Galvanized by the Hot-Dip Process.
F. ASTM A611 - Steel, Cold-Rolled Sheet, Carbon, Structural.
G. AWS D1.1 - Structural Welding Code.
H. SDI - Design Manual for Composite Decks, Form Decks, Roof Decks.

1.5 PERFORMANCE REQUIREMENTS
A. Design metal decking in accordance with SDI Design Manual for Composite Decks, Form Decks, Roof Decks.

B. Calculate to structural limit stress design and maximum vertical deck deflection of 1/240.

C. Lateral deflection of diaphragm shall not exceed 1/500 of the story height.

1.6 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Indicate decking plan, support locations, projections, openings and reinforcement, pertinent details, and accessories. Indicate temporary shoring of decking where required.

C. Product Data: Provide deck profile characteristics and dimensions, structural properties, and finishes.

D. Manufacturer's Installation Instructions: Indicate specific installation sequence, and special instructions.

1.7 QUALIFICATIONS

A. Installer: Company specializing in performing the work of this Section with minimum five (5) years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 01 60 00.

B. Store and protect products under provisions of Section 01 60 00.

C. Cut plastic wrap to encourage ventilation.

D. Separate sheets and store decking on dry wood sleepers; slope for positive drainage.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as shown on Drawings and confirmed by shop drawings.

PART 2 PRODUCTS

2.1 MATERIALS

A. Sheet Steel: ASTM A446, Grade B Structural Quality; with G60 galvanized coating conforming to ASTM A525.

B. Bearing Plates and Angles: ASTM A36 steel, unfinished.


D. Touch-Up Primer: Zinc rich type.

2.2 ACCESSORIES
A. Flute Closures: Closed cell foam rubber, one (1) inch thick; profiled to fit tight to the decking.

2.3 FABRICATION

A. Corrugated Forms: Minimum 26 gauge sheet steel, 9/16 inch high, 30 inch sheets; lapped edges, vent clips deformed ends for ventilation of concrete.

B. Metal Closure Strips, Wet Concrete Screed Angle, Cover Plates, and Related Accessories: 20 gauge galvanized sheet steel; of profile and size as required.

C. Fasteners: Galvanized hardened steel, self-tapping.

D. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

A. Erect metal decking in accordance with SDI Design Manual for Composite Decks, Form Decks, Roof Decks.

B. Bear decking on masonry or concrete support surfaces with 4 inch minimum bearing. Align and level.

C. Bear decking on steel supports with 3 inch minimum bearing. Align and level.

D. Fasten deck to steel support members at ends and intermediate supports with 3/4" puddle welds (through weld washers if 24 ga or thinner) at 12 inches oc maximum, parallel with the deck flute and at each transverse flute.

E. Weld in accordance with AWS D1.1.

F. Mechanically fasten male/female side laps at 24 inches oc maximum.

G. Reinforce steel deck openings from 6 to 18 inches in size with 2 x 2 x 1/4 inch steel angles. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and puddle weld to deck at each flute.

H. Install 6 inch minimum wide sheet steel cover plates, of same thickness as decking, where deck changes direction. Puddle weld 12 inches oc maximum.

I. To contain wet concrete, install stops at floor edge upturned to top surface of slab. Provide stops of sufficient strength to remain stationary without distortion.

J. Install sheet steel closures and angle flashings to close openings between deck and walls, columns, and openings.

K. Install single row of foam flute closures above walls and partitions perpendicular to deck flutes.
L. Weld stud shear connectors through steel deck to structural members below.

M. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up prime paint.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Load bearing formed steel stud exterior wall framing.

1.2 RELATED SECTIONS

A. Section 05 31 10 - Steel Roof Deck: Metal roof decking.
B. Section 05 31 30 - Steel Floor Deck: Metal floor decking
B. Section 06 11 40 - Wood Blocking and Curbing: Rough wood blocking.
C. Section 07 21 00 - Thermal Insulation: Insulation within framing members.
D. Section 07 90 00 - Joint Sealers.
E. Section 09 11 10 - Metal Stud Framing System.
F. Section 09 26 00 - Gypsum Board Systems: Light weight, non-load bearing metal stud framing.
G. Section 09 51 10 - Suspended Acoustical Ceilings: Ceiling suspension system.

1.3 REFERENCES

A. AISI - American Iron and Steel Institute - Cold-Formed Steel Design Manual.
C. ASTM A653 – Sheet Steel, Zinc-coated (Galvanized) by Hot Dip Process.
D. ASTM A1011 – Hot-Rolled Carbon Steel Sheet and Strip.
E. ASTM A1008 – Steel, Cold-Rolled Sheet carbon, Structural.
F. ASTM C955 - Load-Bearing (Transverse and Axial) Steel Studs, Runners (Track), and Bracing or Bridging, for Screw Application of Gypsum Board and Metal Plaster Bases.
I. AWCI (Association of Wall and Ceiling Industries) - Specifications Guide for Cold Formed Steel Structural Members.
J. AWS D1.1 - Structural Welding Code.
K. AWS D1.3 - Light Steel Welding Code.
L. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.
M. MFMA (Metal Framing Manufacturers Association) - Guidelines for the Use of Metal Framing.

1.4 SUBMITTALS

WCPS: Boonsboro High School Auditorium & Stage Renovations
A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, type and location of fasteners, and accessories or items required of related work.

C. Indicate stud and roof joist layout sealed and signed by a qualified registered professional structural engineer licensed in the State of Maryland.
   1. Indicated description of design criteria
   2. Engineering analysis depicting member stresses and deflection.
   3. Member sizes, gauges and connections.
   4. Member truss support reactions.
   5. Top chord, bottom chord and web tracing requirements.

D. Describe method for securing studs to tracks and for bolted or welded framing connections.

E. Product Data: Provide data on standard framing members; describe materials and finish, product criteria and limitations.

F. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

G. Delegated Design Submittal: For cold formed metal framing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Show cold formed metal framing types, connections, types of bracing including special reinforcement. Indicate location, type, magnitude and direction of loads imposed on the building structural frame from cold formed metal framing.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing the work of this section with minimum five (5) years documented experience and approved by manufacturer.

1.6 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.7 COORDINATION

A. Coordinate work under provisions of Section 01 31 00.

B. Coordinate with the placement of components within the stud framing system.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Marino Industries Corp of South Plainfield, NJ
B. ClarkDietrich Building Systems of Baltimore, MD

05 40 00-2 COLD FORMED METAL FRAMING WCPS: Boonsboro High School Auditorium & Stage Renovations

2.2 FRAMING MATERIALS

A. Studs: ASTM C955, formed to channel shape, solid web, knurled faces; 16 gage thick, 1 5/8 inch face and 6 inch depth.

B. Joists: Grade sheet steel, formed to channel shape, punched web; 16 gage thick, 1 1/2 inch face, 10 inch depth.

C. Track: Formed steel; channel shaped; same width as studs, tight fit; 16 gage thick, solid web.

2.3 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered.

B. Plates, Gussets, Clips: Formed sheet steel, thickness determined for conditions encountered.

C. Touch-Up Primer for Galvanized Surfaces: SSPC - Paint 20 Type I Inorganic zinc rich.

2.4 FASTENERS


B. Anchorage Devices: Drilled expansion bolts.

C. Welding: In conformance with AWS D1.1 and AWS D1.3.

2.5 FABRICATION

A. Fabricate assemblies of framed sections of sizes and profiles required; with framing members fitted, reinforced, and braced to suit design requirements.

B. Fit and assemble in largest practical sections for delivery to site, ready for installation.

2.6 FINISHES

A. Studs: Galvanize to CP 60 coating class.

B. Tracks and Headers: Galvanize to CP 60 coating class.

C. Joists: Galvanize to CP 60 coating class.

D. Bracing, Furring, Bridging: Same finish as framing members.

E. Plates, Gussets, Clips: Same finish as framing members.

PART 3 EXECUTION

WCPS: Boonsboro High School Auditorium & Stage Renovations
3.1 EXAMINATION
   A. Verify site conditions under provisions of Section 01 31 00.
   B. Verify that building framing components are ready to receive work.

3.2 ERECTION OF STUDDING
   A. Install components in accordance with manufacturer's instructions.
   B. Align floor and ceiling tracks; locate to partition layout. Secure in place with fasteners by welding at maximum 24 inches oc. Coordinate installation of sealant with floor and ceiling tracks.
   C. Place studs at 16 inches o.c. or 12" o.c. within 6'-0" of corners; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using fastener method.
   D. Construct corners using minimum three studs. Double stud wall openings, door and window jambs.
   E. Erect load bearing studs one piece full length. Splicing of studs is not permitted.
   F. Erect load bearing studs, brace, and reinforce to develop full strength, to achieve design requirements.
   G. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
   H. Install intermediate studs above and below openings to align with wall stud spacing.
   I. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.
   J. Attach cross studs to studs for attachment of fixtures anchored to walls.
   K. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
   L. Touch-up field welds and damaged galvanized surfaces with primer.

3.3 ERECTION OF JOISTS
   A. Install framing components in accordance with manufacturer's instructions.
   B. Make provisions for erection stresses. Provide temporary alignment and bracing.
   C. Place joists as indicated at 16 inches o.c.; not more than 2 inches from abutting walls. Connect joists to supports using fastener method.
   D. Set floor joists parallel and level, with lateral bracing and bridging.
   E. Locate joist end bearing directly over load bearing studs or provide load distributing member to top of stud track.
   F. Provide web stiffeners at reaction points.
G. Touch-up field welds and damaged galvanized surfaces with zinc rich primer.

3.4 ERECTION TOLERANCES

A. Maximum Variation from True Position: 1/4 inch in ten (10') feet.

B. Maximum Variation of any Member from Plane: 1/8 inch.

END OF SECTION
PART 1  GENERAL

1.1  SECTION INCLUDES

A. Shop fabricated ferrous metal items, galvanized and prime painted.

1.2  PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 03 30 00 - Cast-In-Place Concrete: Placement of metal fabrications in concrete.
B. Section 04 30 00 - Unit Masonry System: Placement of metal fabrications in masonry.

1.3  RELATED SECTIONS

A. Section 05 12 00 - Structural Steel: Structural steel column anchor bolts.
B. Section 05 21 00 - Steel Joists: Structural joist bearing plates, including anchorage.
C. Section 05 31 10 - Steel Roof Deck: Bearing plates and angles and frame openings for metal deck bearing, including anchorage.
D. Section 05 52 00 - Handrails and Railings.
E. Section 09 90 00 - Painting: Paint finish.

1.4  REFERENCES

A. ASTM A36 - Structural Steel.
B. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
C. ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated From Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip.
D. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
E. ASTM A283 - Carbon Steel Plates, Shapes, and Bars.
G. ASTM A325 - High Strength Bolts for Structural Steel Joints.
H. ASTM A386 - Zinc-Coating (Hot-Dip) on Assembled Steel Products.
I. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
J. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
K. ASTM B177 - Chromium Electroplating on Steel for Engineering Use.
L. AWS A2.0 - Standard Welding Symbols.
M. AWS D1.1 - Structural Welding Code.
N. SSPC - Steel Structures Painting Council.

1.5 SUBMITTALS
   A. Submit under provisions of Section 01 33 00.
   B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   C. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

1.6 QUALIFICATIONS
   A. Welders' Certificates: Submit under provisions of Section 01 33 00, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.7 FIELD MEASUREMENTS
   A. Verify that field measurements are as indicated on Drawings and shop drawings.

PART 2 PRODUCTS

2.1 MATERIALS
   A. Steel Sections: ASTM A36.
   B. Steel Tubing: ASTM A500, Grade B.
   C. Plates: ASTM A283.
   E. Fasteners: As detailed.
   F. Bolts, Nuts, and Washers: ASTM A325 galvanized to ASTM A153 for galvanized components.
   G. Welding Materials: AWS D1.1; type required for materials being welded.
   H. Shop and Touch-Up Primer: SSPC 6 - SP6 Commercial Blast Cleaning and Prime.
   I. Touch-Up Primer for Galvanized Surfaces: PPG Zinc rich type 6-209 galvanized steel primer.

2.2 FABRICATION
   A. Fit and shop assemble in largest practical sections, for delivery to site.
   B. Fabricate items with joints tightly fitted and secured.
   C. Continuously seal joined members by continuous welds.
D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.3 FINISHES

A. Prepare surfaces to be primed in accordance with SSPC SP 6- Commercial Blast Cleaning.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime paint items with PPG Water Base Inhibitive Metal Primer 90-712 at 4.8 mils MWF.

D. Galvanize in accordance with ASTM A123, structural steel members. Provide minimum 1.25 oz/sq ft galvanized coating.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Beginning of installation means erector accepts existing conditions.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate sections.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components indicated on Drawings and shop drawings.

D. Perform field welding in accordance with AWS D1.1.

E. Obtain Architect/Engineer approval prior to site cutting or making adjustments not scheduled.

F. After erection, clean, brush and prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.
3.4 ERECTION TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset from True Alignment: 1/4 inch.

3.5 SCHEDULE

A. The Schedule is a list of principal items only. Refer to Drawing details for items not specifically scheduled.

1. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; galvanized with painted finishes. Omit quenching process of steel for adequate paint adhesion.

2. Ledge and Shelf Angles, Channels and Plates Not Attached to Structural Framing: For support of metal decking joists masonry; prime paint finish.

3. Lintels: As detailed; Interior: prime paint finish;
Exterior: galvanized finish.

4. Concrete Edge Protective Angles: For edge protection at concrete curbs and or steps; galvanized finish.

5. Roof Ladder: As detailed within contract documents. Prepare metal in accordance with SSPC-6-SP6 and prime paint. Finish in accordance with Section 09 90 00.

END OF SECTION
PART 1  GENERAL

1.1  SECTION INCLUDES

   A. Steel stair frame of structural sections, with closed risers.

1.2  PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

   A. Furnish anchors to be embedded in masonry to Section 04 30 00 - Unit Masonry System.

1.3  RELATED SECTIONS

   A. Section 05 52 00 - Handrails and Railings: Handrails and balusters other than specified in this Section.
   B. Section 09 90 00 - Painting: Finish.

1.4  REFERENCES

   B. ASTM A36 - Structural Steel.
   C. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
   E. ASTM A386 - Zinc-Coating (Hot-Dip) on Assembled Steel Products.
   F. ASTM A446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
   G. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
   I. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
   J. AWS D1.1 - Structural Welding Code.

1.5  STRUCTURAL REQUIREMENTS

   A. Fabricate stair assembly to support live load of 100 lb/sq ft or 300 lb/tread non-concurrent with deflection of stringer or landing framing not to exceed 1/360 of span.
   B. Railing assembly, wall rails, and attachments to resist lateral force of 200 lbs at any point without damage or permanent set.

1.6  SUBMITTALS

   A. Submit under provisions of Section 01 33 00.
   B. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, openings, size
and type of fasteners, and accessories.

C. Include erection drawings, elevations, and details where applicable.

D. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

E. Submit samples under provisions of Section 01 33 00.

1.7 WARRANTY

A. Provide a one year warranty defective materials, workmanship and parts for all stairs and fabricated accessories.

PART 2  PRODUCTS

2.1 MATERIALS

A. Steel Sections: ASTM A36.

B. Steel Tubing: ASTM A53, Grade B, Schedule 40.


D. Stair Treads: Equal to McNichols GW125 with Type B (Checkered Plate) nosing. Bearing bar size 1-1/4 inch x 3/16 inch.

E. Welding Materials: AWS D1.1; type required for materials being welded.

F. Primer: PPG Water Base Inhibitive Metal Primer 90-712 at 4.8 mils MWF.

G. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of structure.

2.2 FABRICATION - GENERAL

A. Verify dimensions on site prior to shop fabrication.

B. Fabricate items with joints tightly fitted and secured.

C. Fit and shop assemble sections in largest practical sizes, for handling through building openings.

D. Grind exposed welds flush and smooth with adjacent finish surface. Ease exposed edges to small uniform radius.

E. Make exposed joints butt tight, flush, and hairline

F. Accurately form components required for anchorage of stairs and landings and railings to each other and to building structure.

2.3 FABRICATION - PAN STAIRS AND LANDINGS

A. Fabricate stairs with closed risers and treads grate construction.

B. Form treads and risers from minimum 10 gage sheet stock.
C. Secure tread pans to stringers with clip angles, welded in place.

D. Form stringers of rolled steel channels, 12 inches deep.

E. Form landings from minimum 10 gage sheet stock. Reinforce underside with channels to attain design load requirements.

F. Prime paint components.

2.4 FINISHES

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing in accordance with SSPC-SP6-Commercial Blast Cleaning.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime paint items specified with one coat at 3.6 MWF DFM.

PART 3 EXECUTION

3.1 EXAMINATION

A. Erect stairs level and plumb, free from distortion or defects detrimental to appearance or performance.

B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.

C. Verify alignment with adjacent construction. Coordinate related work.

D. Do not field cut or alter members.

E. Field bolt and weld to match shop bolting and welding. Hide bolts and screws wherever possible. Where not hidden, use flush countersunk fastenings.

F. Mechanically fasten joints butted tight, flush, and hairline. Grind welds smooth and flush.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior and interior steel handrail.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 03 30 00 - Cast-In-Place Concrete: Placement of anchors in concrete.
B. Section 04 30 00 - Unit Masonry System: Placement of anchors in masonry.

1.3 REFERENCES

A. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
B. ASTM A386 - Zinc-Coating (Hot-Dip) on Assembled Steel Products.
C. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
D. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
E. ASTM B211 - Aluminum-Alloy Bars, Rods, and Wire.
F. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
H. ASTM B483 - Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications.
I. SSPC - Steel Structures Painting Council.

1.4 DESIGN REQUIREMENTS

A. Railing assembly, wall rails, and attachments to resist lateral force of 200 lbs at any point without damage or permanent set.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.
B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
C. Samples: Submit two, 12 inch long samples of handrail. Submit two samples, of elbow, Tee, wall bracket, escutcheon and end stop.

1.6 FIELD MEASUREMENTS
A. Verify that field measurements are as indicated on Drawings and approved shop drawings.

PART 2 PRODUCTS

2.1 STEEL RAILING SYSTEM

B. Rails and Posts: 1-1/2 inch diameter steel tubing; welded joints.
C. Posts: 1-1/2 inch diameter steel tubing; welded joints.
D. Fittings: Elbows, T-shapes, wall brackets, escutcheons; machined steel suitable for flush welding.
E. Mounting: fixed brackets and flanges. Prepare backing plate for mounting in wall construction.
F. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.
G. Splice Connectors: Steel concealed spigots welding collars.
H. Mesh: Plain steel wire mesh 1-3/4” x 1-3/4” square opening.
I. Shop and Touch-Up Primer: SSPC-SP6 - Commercial Blast: Cleaning and primed with PPG Water Base Inhibitive Metal Primer 90-712 at 4.8 mils MWF.

2.2 FABRICATION

A. Fit and shop assemble components in largest practical sizes, for delivery to site.
B. Fabricate components with joints tightly fitted and secured.
C. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
E. Continuously seal joined pieces by continuous welds.
F. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
G. Accurately form components to suit stairs and landings, to each other and to building structure.

PART 3 EXECUTION
3.1 EXAMINATION
   A. Verify that field conditions are acceptable and are ready to receive work.
   B. Beginning of installation means erector accepts existing conditions.

3.2 PREPARATION
   A. Clean and strip primed steel items to bare metal where site welding is required.
   B. Supply items required to be cast into concrete and or embedded in masonry or placed in partitions with setting templates, to appropriate Sections.

3.3 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Install components plumb and level, accurately fitted, free from distortion or defects.
   C. Provide anchors, plates, angles required for connecting railings to structure. Anchor railing to structure.
   D. Field weld anchors as indicated on drawings, shop drawings. Touch-up welds with primer. Grind welds smooth.
   E. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.4 ERECTION TOLERANCES
   A. Maximum Variation from Plumb: 1/4 inch per story, non-cumulative.
   B. Maximum Offset from True Alignment: 1/4 inch.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Work of this section includes materials, accessories and related items for the complete installation of column covers.

B. Related work specified elsewhere includes internal post structure for solid support of column covers.

1.2 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Submit complete shop drawings indicating quantities, finishes, dimensions, and attachment relationships.

C. Submit manufacturers product data, specifications and installation instructions.

D. Submit color and finish samples to determine range of texture and consistency of color and finish to be expected in the finished work. Standard sample size shall be 3” x 3”.

1.3 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of 5 years’ experience in manufacturing architectural metals.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver components in clearly marked containers and packages suitable for shipment of specified products so as to prevent finish damage in transit. Provide protective wrapping or film to provide protection.

B. Store components in locations that will avoid damage from job-site traffic, moisture, stacking or other job-site contamination.

C. Handle components to avoid racking, twisting, denting or scratching of finished surfaces.

1.5 WARRANTY:

A. Section 01 73 00 – Execution Requirements: Product warranties

B. Provide manufacturer’s warranty against defects in material and workmanship for a period of one year beginning on Date of Substantial Completion.

RETAIN OPTIONAL FINISH WARRANTY FOR FLUOROPOLYMER FINISH AT NO ADDITIONAL COST.
C. Finish warranty: Warrant fluoropolymer coating to remain free, under normal atmospheric conditions, from peeling, checking, cracking, chalking in excess of numerical rating of 8 when measured in accord with ASTM D4214, of fading in excess of 5 N.B.S. Units during warranty period. Warranty period shall be 20 years, beginning at Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Acceptable products include column covers manufactured by: Fry Reglet Corporation, Series R – Reveal vertical joint.

FRY REGLET CORPORATION
1377 Stonefield Court
Alpharetta, GA 30004
Phone 800-955-2343 FAX 800-200-4379

B. Substitutions: Under provisions of Section 01 60 00.

2.2 PRODUCTS

A. SERIES R - REVEAL VERTICAL JOINT
   a. Thickness: 0.090”.
   b. Finish: Kynar 500 Paint - Fluoropolymer.
   c. Color: As selected by Architect from manufacturer’s standard color selections.
2. Extruded aluminum posts: 6063 allow, temper T5 meeting ASTM B221 and have minimum wall thickness of 0.120”.
3. ½” x ½” square black anodized bar at reveals

B. MANUFACTURED UNITS:
2. Diameter: 24 inches
3. Joint type: 1/2” x 1/2” reveal insert.
4. Horizontal:
5. Floor: Fixed inset base reveal.

C. FABRICATION
1. Form column covers to specified dimensions and diameters as indicated on shop drawings.
2. Provide column covers in sections a maximum 12’ 0” tall per section.
3. Provide additional sections to achieve finished heights above 12’ 0”.
4. Columns shall have no exposed fasteners unless specified.
5. Provide additional bracing components as necessary to stiffen substructure and insure solid mid-span bracings and connections.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 – Administrative Requirements: Coordination and project conditions.

B. Examine job-site conditions for conditions that may adversely affect installation of column covers.

C. Verify dimensions of column covers prior to installation to assure compatibility with job-site conditions.

D. Verify post structure is plumb, level, and parallel prior to installation of column covers. Refer to Section 01 40 00 – Quality Requirements tolerances.

E. Visually examine finished surfaces to assure that blemished or dented surfaces are not present prior to installation.

3.2 PREPARATION

A. Verify/coordinate with other trades prior to installation insofar as they are affected by column cover installation.

3.3 INSTALLATION

A. Install components in accord with manufacturer’s installation instructions and approved shop drawings.

B. Anchor components to related structures such as floors, walls and beams as indicated on approved shop drawings. Use anchors with holding strength to provide a solid installation. Use only plated, galvanized or stainless steel anchors.

3.4 CLEANING

A. Section 01 73 00 – Execution Requirements: Final cleaning.

B. Remove protective coverings and clean column covers to remove adhesives and tape residue. Test all solvents on non-exposed surfaces prior to use.
   1. For painted surfaces, use a mild detergent solution on a soft cloth.
   2. For stainless steel, use a glass cleaner and a soft cloth.
   3. For other surfaces, contact manufacturer for proper cleaning procedures.

C. Visually inspect all exposed surfaces for scratches or blemishes.

D. Protect column covers from damage during remainder of construction period.

END OF SECTION
PART 1  GENERAL

1.1  SUMMARY

A.  Section Includes:
   1. Ornamental railings.
   2. Swing gates.

1.2  DEFINITIONS

A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas, pedestrian guidance and support, visual separation, or wall protection.

1.3  PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
   1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
   2. Stainless Steel: 60 percent of minimum yield strength.
   3. Steel: 72 percent of minimum yield strength.

C. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails and Top Rails of Guards:
      a. Uniform load of 50 lbf/ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Infill of Guards:
      a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
      b. Infill load and other loads need not be assumed to act concurrently.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4  SUBMITTALS

A. Product Data: For the following:
   1. Manufacturer's product lines of railings assembled from standard components.
2. Grout and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. For illuminated railings, include wiring diagrams and roughing-in details.

C. Samples for Initial Selection: For products involving selection of color, texture, or design, including mechanical finishes.

D. Samples for Verification: For each type of exposed finish required.
   1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
   2. Each type of glass required.
   3. Fittings and brackets.
   4. Welded connections.
   5. Brazed connections.
   6. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.

E. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Qualification Data: For qualified professional engineer.

G. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

H. Welding certificates.

I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including structural analysis, preconstruction testing, field testing, and in-service performance.
   1. Do not modify intended aesthetic effects, as judged solely by Professional, except with Professional’s approval. If modifications are proposed, submit comprehensive explanatory data to Professional for review.

C. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
D. Safety Glazing Labeling: Permanently mark glass with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockups as shown on Drawings.
   2. Build mockups for each form and finish of railing consisting of two posts, top rail, infill area, and anchorage system components that are full height and are not less than 24 inches in length.
   3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION AND SCHEDULING

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not suit structural performance requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Ornamental Railings:
      b. Blumcraft of Pittsburgh.
      c. Livers Bronze Co.

2.2 ORNAMENTAL PICKET FENCE

A. Pickets: Fabricated of galvanized steel tubular members per ASTM A787 with a G90 zinc coating 0.90 oz/ft² and stall to have 45,000 psi (310 MPa) yield strength. Picket size shall be \( \frac{3}{4}'' \) or 1” sq. x 16 or 18 gauge wall thickness, and spaced at 3-15/16” face to face. Pickets shall be attached to rails using \( \frac{1}{4}'' \) industrial drive rivets.
B. Rails: Horizontal U channels shall be 1-1/2” x 1-1/2” 15 gauge wall thickness (0.72”) and galvanized: G90 zinc coating 0.90 oz/ft², manufactured per ASTM A-653/A-653M with a 50,000 psi (344 MPa) yield strength. Rails shall be mechanically punched to receive pickets and drive rivets. Attach rails to brackets using one-way security fastener.

C. Posts: Fabricated of galvanized square steel tubular members per ASTM A787 with a G90 zinc coating, 0.90 oz/ft² and steel to have 45,000 psi (310 MPa) yield strength. Post size options (3” sq x 12 gauge) or (2-1/2” square 14 or 12 gauge) wall thickness.

D. Finish: All posts, caps and fence panels shall be polyester coated individually after fabrication to thoroughly coat all surfaces for additional corrosion protection. All components enter a 5 stage in line cleaning process to prepare the galvanized surfaces for complete adhesion of the finish coat. Components are given a TGIC polyester resin powder coating applied by the electrostatic spray process to 3.0 mill thickness. The finish is baked in an oven for 15-20 minutes at a temperature ranging from 400°F. Colors are available in black or white (brown, ensor green, woodland green and specials).

2.3 STEEL AND IRON

A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Tubing: ASTM A 500 (cold formed).

C. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.

D. Plates, Shapes, and Bars: ASTM A 36/A 36M.

E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.4 ACCESSORIES

A. Post Caps: Aluminum or formed steel manufactured to form a weather-tight closure. Caps shall be ball type or flat top (choose one) style on each post.

B. Rail/Post Brackets: Standard 1-1/2” x 1-1/2”, 15 gauge galvanized steel channels. Cover to be pressed to bracket for permanent installation. Bracket shall be fastened to post with one galvanized hex bolt. Rails shall be attached to bracket with one-way security fastener.

C. Rings: Cast aluminum rings attached to rails by insertion of mounting block into upper rail. Rings attached to rails with standard drive rivet to prevent removal.

D. Pickets: Shall be secured to rail with ¼” aluminum industrial drive rivets to prevent movement. Rivets have a shear strength of 1,500# and a holding power of 1,100#.

E. Final Tops of Pickets: Cast aluminum, attached to pickets by ¼” rivets.

F. Picket Tops: Flat top pickets with plugs.
2.5 ORNAMENTAL SWING GATES

A. Gate Frame: Ornamental picket swing gate frames to be fabricated of galvanized steel tubing. ASTM A-653, of structural steel having a 45,000 psi (310 MPa) tensile strength and a G90 0.9 oz/ft^2 zinc coating. Members welded with stainless steel rods, forming a rigid one piece unit. Vertical upright member’s 2” sq. 13 gauge metal thickness.

B. Horizontal Rails and Pickets:
1. For gate leaves up to 8'-0” the horizontal rails to be “U” channels formed of hot rolled, structural steel 1-3/8” wide by 1-1/2” high, 11 gauge (0.120”) metal thicknesses. Rails must be punched to receive pickets and rivets. Rails stainless steel welded inside vertical members. Pickets are galvanized steel (Choose one: ¾” or 1” to match fence sections.) Pickets attached to “U” channels using ¼” industrial drive rivets.
2. For gate leaves 8’-1” up to 12'-0” provide an additional 1-1/2” sq. stiffener welded to one top and one bottom “U” channel. Use stainless steel rods for welds.
3. For gate leaves 12’-1” to 18’-0” supply 2 additional 2” sq. horizontal members welded to the 2” sq. vertical members forming a 2” sq. rectangular frame. Welds to be stainless steel.
4. For gate leaves 18’-1” to 24’-0” 2 additional horizontal stiffener 2’ sq. to be welded behind 2” horizontal members. Welds to be stainless steel.
5. Bracing: Provide diagonal adjustable length truss rods to prevent sagging. One truss rod per 8’ maximum of length of gate panel.
6. Double gates consist of 2 each of the above gate leaves.

C. Hardware: galvanized steel and/or malleable steel to suit application. Latch shall have provisions for padlocking. Hinges shall grip post and frame firmly to prevent slippage. Hinges shall have a load capacity of 1,000 lbs. Hinges shall allow gate leaf to swing 180°.

D. Gate keeper shall be provided for any leaf wider than 5’-0” to hold gate in open position.

E. Double leaf gates to have center drop rod to enable one leaf to be made stationary while that latch shall lock both leaves together.

F. Gate Posts: Square gate posts (ASTM A-653) 45,00 psi (MPa) tensile strength with G90 galvanized coating in sizes shown below:
1. 3” sq. for gate leave 3’-0” to 4’-0”
2. 4” sq. for gate leave 4’-1” to 8’-0”
3. 3” sq. for gate leave 8’-0” to 12’-0”
4. 3” sq. for gate leave 12’-1” to 18’-0”
5. 3” sq. for gate leave 18’-0” to 24’-0”

G. Finish: All steel parts to be galvanized to prevent corrosion. Next, pre-treat and clean surfaces to accept finish coat. Apply 3 mils of TGIC polyester powder coating applied by electrostatic spray process baked at 450° F until finish is cured onto metal. Gates to be coated after all welding is completed.

2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
2.7 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove flux immediately.
   4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.

H. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

I. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
   1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

J. Form changes in direction as follows:
   1. By bending or by inserting prefabricated elbow fittings.

K. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of hollow railing members with prefabricated end fittings.
M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inch or less.

N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
   1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

P. For removable railing posts, fabricate slip-fit sockets from steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.
   1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.
B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
   1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
   2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
   3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

F. Install gate posts a minimum of 36” into firm soil. The diameter of the footing to be 4 times the diameter of the post. Footing should be 6” deeper than the bottom of the posts, 42”. Finish concrete with a slop for all water to drain away from post.

G. Attach all hardware to gate in such a way that it cannot be removed by unauthorized persons.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ATTACHING RAILINGS

A. Anchor railing ends to concrete and masonry with brackets on underside of rails connected to railing ends and anchored to wall construction with anchors and bolts.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and connected to railing ends using nonwelded connections.

C. Attach handrails to walls with wall brackets except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

D. Secure wall brackets and railing end flanges to building construction as follows:
   1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
   2. For hollow masonry anchorage, use toggle bolts.
   3. For steel-framed partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.
   4. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.
   5. For steel-framed partitions, fasten brackets with toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.5 FIELD QUALITY CONTROL
   A. Testing Agency: The Contractor will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports. Extent and Testing Methodology: Testing agency will randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed Work. Railings will be tested according to ASTM E 894 and ASTM E 935 for compliance with performance requirements.
   B. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and will comply with specified requirements.
   C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 CLEANING
   A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.
   B. Clean and polish glass as recommended in writing by manufacturer. Wash both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion.
   C. Clean wood rails by wiping with a damp cloth and then wiping dry.

3.7 PROTECTION
   A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
   B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Expansion joint assembly for floor surfaces.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 03 30 00 - Cast-in-Place Concrete: Placement of joint assembly frames in concrete.

B. Section 04 30 00 - Unit Masonry System: Placement of joint assembly frames in masonry.

1.3 RELATED SECTIONS

A. Section 07 90 00 - Joint Sealers: Expansion and control joint finishing utilizing a sealant and bond breaker.

1.4 REFERENCES

A. ANSI/ASTM B221 - Aluminum-Alloy, Extruded Bar, Rod, Wire, Shape and Tube.

B. ANSI/ASTM B308 - Aluminum Alloy, Standard Structural Shapes, Rolled or Extruded.


1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Provide joint assembly profiles, dimensions locations in the Work, affected adjacent construction, anchorage devices, available colors and finish, and locations of splices.

C. Submit two samples 12 x 8 inches in size, illustrating profile, dimension, color and finish selected.

D. Manufacturer’s Installation Instructions: Indicate rough-in sizes. Provide templates for cast-in or placed frames or anchors and indicate tolerances for item placement.

1.6 FIELD MEASUREMENTS

A. Verify that field measurements are as instructed by the manufacturer.

1.7 EXTRA MATERIALS

A. Furnish under provisions of Section 01 73 00.

B. Provide 20 ft. of resilient joint filler, and special tools required for servicing components.

PART 2 PRODUCTS

WCPS: Boonsboro High School Auditorium & Stage Renovations
2.1 MATERIALS
   A. Extruded Aluminum: ANSI/ASTM B221; alloy, temper B308; T5 temper.
   C. Threaded Fasteners; Aluminum.
   D. Backing Paint; Asphalitic type.

2.2 FABRICATION
   A. Joint Covers: Aluminum cover plate, aluminum frame construction, retainers with resilient vinyl filler strip, designed to permit plus or minus 50 percent joint movement with a full recovery, flush and recess mounted; refer to Schedule.
   B. Back paint components in contact with cementitious materials.
   C. Galvanize embedded ferrous metal anchors and fastening devices.
   D. Shop assemble components and package with anchors and fittings.
   E. Provide joint components in single length wherever practical. Minimize site splicing.

2.3 FINISHES
   A. Floors: Mill finish.
   B. Walls: Clear anodized or as otherwise scheduled.
   C. Resilient Filler Exposed to View: As selected by Architect from manufacturer’s standard line of colors.

PART 3 EXECUTION

3.1 EXAMINATION
   A. Verify existing conditions under provisions of Division 1.
   B. Verify that joint preparation and affected dimensions are acceptable.

3.2 PREPARATION
   A. Provide anchoring devices for installation and embedment.
   B. Provide templates and rough-in measurements.

3.3 INSTALLATION
   A. Install components and accessories in accordance with manufacturer's instructions.
   B. Align work plumb and level, flush with adjacent surfaces.
   C. Rigidly anchor components to substrate to prevent misalignment.
3.4 PROTECTION OF FINISHED WORK

A. Protect finished work under provisions of Division 1.

B. Do not permit traffic over unprotected floor joint surfaces.

C. Provide removable strippable coating to protect finish surface.

3.5 SCHEDULES

A. Floor to Floor Expansion Joint: MM Systems Model X-GLMV install flush with finish floor surface.

END OF SECTION
PART 1   GENERAL

1.1   SECTION INCLUDES

   A. Roof curbs and cants.
   B. Blocking in wall and roof openings.
   C. Wood furring and grounds.
   D. Concealed wood blocking for support of toilet and bath accessories, wall cabinets and wood trim.
   E. Telephone and electrical panel boards.
   F. Preservative treatment of wood.

1.2   RELATED SECTIONS

   A. Section 03 30 00 - Cast-in-Place: Concrete openings to receive wood blocking.
   B. Section 04 30 00 - Unit Masonry System: Masonry openings to receive wood blocking.
   C. Section 06 16 00 – Sheathing.

1.3   REFERENCES

   A. ALSC (American Lumber Standards Committee) - Softwood Lumber Standards.
   B. APA (American Plywood Association).
   C. AWPA (American Wood Preservers Association) C1 - All Timber Products Preservative Treatment by Pressure Process.
   E. NFPA (National Forest Products Association).
   F. RIS (Redwood Inspection Service).
   G. SPIB (Southern Pine Inspection Bureau).
   H. WCLIB (West Coast Lumber Inspection Bureau).
   I. WWPA (Western Wood Products Association).

1.4   QUALITY ASSURANCE

   A. Perform Work in accordance with the following agencies:
1. Lumber Grading Agency: Certified by ALSC.
2. Plywood Grading Agency: Certified by APA.

1.5 SUBMITTALS

A. Product Data: In accordance with Section 01330, submit manufacturer’s certification for pressure-treated and fire-treated lumber.

PART 2 PRODUCTS

2.1 MATERIALS

A. Lumber Grading Rules: WCLIB and WWPA.

B. Miscellaneous Framing: Stress Group D, S.P.F. species, 19 percent maximum moisture content, pressure preservative treat when wood is in contact with concrete, masonry or metal.

C. Plywood: APA Grade C-C-X; unsanded.
   1. Fire Retardant Treated: Locations as indicated in Drawings or as listed below.
   2. Tongue and Groove: As indicated in Drawings.

D. Particle board: Will not be acceptable.

2.2 ACCESSORIES

A. Fasteners and Anchors:
   1. Fasteners: Hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
   2. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

2.3 FACTORY WOOD TREATMENT

A. Wood Preservative (Pressure Treatment) EPA Approved: AWPA Treatment C1 using water borne preservative with 0.060 L.I.S. CF retainage.
   1. Products treated with “CCA” (chromated copper arsenate) will not be permitted.
   2. “ACQ” (amine copper qust) or “CBA” (copper baron azole) treated products will be acceptable.

B. Fire Treatment: Shall be equal to Hoover Treated Wood Products, Inc. of Milford, VA (804) 633-5021 Pyro-Guard Complying with AWPA Type A fire retardant treatment and shall have a flame spread rating of 25 or less when tested in accordance with ASTM E-84.
   1. Interior Fire retardant treated lumber and plywood shall have an equilibrium moisture content of not over 28% when tested in accordance with ASTM D-3201 at 92% relative humidity.
   2. Each piece of fire retardant treated lumber and plywood shall be manufactured under Underwriters Laboratories and shall bear the UL Qualification label for surface burning characteristics in the 30 minute E-84 flame test and also indicate kiln drying after treatment (KDAT).
PART 3 EXECUTION

3.1 FRAMING

A. Set members level and plumb, in correct position.

B. Place horizontal members, crown side up.

C. Construct curb members of single pieces.

D. Space framing and furring 16 inches oc.

E. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

F. Coordinate curb installation with installation of decking and support of deck openings, and parapet construction.

3.2 TELEPHONE AND ELECTRIC BOARDS

A. Install telephone and electrical panel boards with fire-treated plywood sheathing material where required. Size the back board by 12 inches beyond size of electrical panel, or as indicated on drawings.

END OF SECTION
PART 1  GENERAL

1.1  SECTION INCLUDES

A.  Finish carpentry items, including finish trim.
B.  Hardware and attachment accessories.

1.2  RELATED SECTIONS

A.  Section 06 11 40 - Wood Blocking and Curbing: Grounds and support framing.
B.  Section 08 21 00 - Wood Doors.
C.  Section 08 80 00 - Glazing: Glass and glazing of wood partitions screens.
D.  Section 09 90 00 - Painting: Painting and finishing of finish carpentry items.

1.3  REFERENCES

B.  AWI - Quality Standards.
E.  BHMA A156.9 - Cabinet Hardware.
F.  FS MMM-A-130 - Adhesive, Contact.
G.  HPMA (Hardwood Plywood Manufacturer's Association) HP - American Standard for Hardwood and Decorative Plywood.
H.  NEMA (National Electric Manufacturers Association) LD3 - High Pressure Decorative Laminates.
I.  NHLA (National Hardwood Lumber Association).
J.  NWWDA (National Wood Window and Door Association) I.S.4 - Water Repellent Preservative Treatment for Millwork.
K.  PS 1 - Construction and Industrial Plywood.

1.4  SUBMITTALS

A.  Submit under provisions of Section 01 33 00.
B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories, to a minimum scale of 1-1/2 inch to 1 ft.

C. Provide instructions for attachment hardware.

D. Samples: Submit two samples of ballet bar, 12 inch in size illustrating wood grain and specified finish.

E. Submit two samples of wood trim six (6) inches long.

1.5 QUALITY ASSURANCE
A. Perform work in accordance with AWI Premium Custom Economy quality. NHLA.

1.6 QUALIFICATIONS
A. Fabricator: Company specializing in fabricating the products specified in this section with minimum five (5) years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.
B. Protect work from moisture damage.

1.8 FIELD MEASUREMENTS
A. Verify that field measurements are as indicated on shop drawings.

1.9 COORDINATION
A. Coordinate work under provisions of Section 01 31 00.

PART 2 PRODUCTS

2.1 LUMBER MATERIALS
A. Softwood Lumber: PS 20; Graded in accordance with AWI Custom; white pine species, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.

B. Hardwood Lumber: Graded in accordance with AWI Custom Premium; Maple species, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.

2.2 SHEET MATERIALS
A. Softwood Plywood: PS 1 Grade C-D; Graded in accordance with AWI Custom; veneer lumber core; White Pine species, cut.

B. Wood Particleboard: Will not be allowed.

2.3 FASTENERS
A. Fasteners: Of size and type to suit application; galvanized finish in concealed locations and stainless steel finish in exposed locations.
B. Concealed Joint Fasteners: Threaded steel.

2.4 ACCESSORIES
A. Lumber for Shimming: Softwood lumber of cedar species.
B. Primer: Alkyd primer sealer type.
C. Wood Filler: Solvent Oil base, tinted to match surface finish color.

2.5 FABRICATION
A. Fabricate to AWI Custom standards.
B. Shop assemble work for delivery to site, permitting passage through building openings.
C. Fit exposed sheet material edges with 3/8 inch (9.5 mm) matching hardwood veneer or plastic laminate edging matching adjacent surface. Use one piece for full length only.
D. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify adequacy of backing and support framing.
B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.2 INSTALLATION
A. Install work in accordance with AWI Custom Quality Standard.
B. Set and secure materials and components in place, plumb and level.
C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.
D. Install components and trim with nails, screws, or bolts with blind fasteners at 16 inch on center.
F. Install hardware in accordance with manufacturer's instructions.

3.3 ERECTION TOLERANCES
A. Maximum Variation from True Position: 1/16 inch.
B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION
PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including general and supplementary conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following horizontal and trim solid surface product types:
   1. Lavatory tops with undermount bowls
   2. Countertops

B. Related Sections include the following:
   1. Section 06 11 40 – Wood Blocking and Curbing
   2. Division 22 - Plumbing
   3. Division 26- Electrical

1.3 DEFINITION

A. Solid surface is defined as nonporous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

1.4 SUBMITTALS

A. Product data:
   1. For each type of product indicated.

B. Shop drawings:
   1. Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices and other components.
      a. Show full-size details, edge details, thermoforming requirements, attachments, etc.
      b. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement specified in other Sections.
      c. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacle and other items installed in solid surface.

C. Samples:
   1. For each type of product indicated.
      a. Submit minimum 6-inch by 6-inch sample in specified gloss.
      b. Cut sample and seam together for representation of inconspicuous seam.
      c. Indicate full range of color and pattern variation.
   2. Approved samples will be retained as a standard for work.

D. Product data:
   1. Indicate product description, fabrication information and compliance with specified performance requirements.
E. Fabricator/installer qualifications:
   1. Provide copy of certification number.

F. Manufacturer certificates:
   1. Signed by manufacturers certifying that they comply with requirements.

G. Maintenance data:
   1. Submit manufacturer’s care and maintenance data, including repair and cleaning instructions.
      a. Maintenance kit for finishes shall be submitted.
   2. Include in project closeout documents.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Shop that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in-service performance.

B. Fabricator/installer qualifications:
   1. Work of this section shall be by a certified fabricator/installer, certified in writing by the manufacturer.

C. Applicable standards:
   1. Standards of the following, as referenced herein:
      a. American National Standards Institute (ANSI)
      b. American Society for Testing and Materials (ASTM)
      c. National Electrical Manufacturers Association (NEMA)
   2. Fire test response characteristics:
      a. Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E84) or another testing and inspecting agency acceptable to authorities having jurisdiction:
         1) Flame Spread Index: 25 or less.
         2) Smoke Developed Index: 450 or less.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver no components to project site until areas are ready for installation.

B. Store components indoors prior to installation.

C. Handle materials to prevent damage to finished surfaces.
   1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.7 WARRANTY

A. Provide manufacturer’s warranty against defects in materials.
   1. Warranty shall provide material and labor to repair or replace defective materials.
   2. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.
B. Optional Installed Warranty:
   1. To qualify for the optional Installed Warranty, fabrication and installation must
      be performed by a DuPont Certified Fabrication/Installation source who will
      provide a brand plate for the application.
   2. This warranty covers all fabrication and installation performed by the
      certified/approved source subject to the specific wording contained in the
      Installed Warranty Card.

C. Manufacturer’s warranty period:
   1. Ten years from date of substantial completion.

1.8 MAINTENANCE

A. Provide maintenance requirements as specified by the manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
   1. Subject to compliance with requirements, provide products by one of the
      following:
      a. DuPont Corian (basis of design).
      b. Wilsonart
      c. Formica

2.2 MATERIALS

A. Solid polymer components
   1. Cast, nonporous, filled polymer, not coated, laminated or of composite
      construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6,
      having minimum physical and performance properties specified.
   2. Superficial damage to a depth of 0.010 inch (.25 mm) shall be repairable by
      sanding and/or polishing.

B. Thickness: 1/2 inch

C. Edge treatment:
   1. No Drip

D. Backsplash: Applied- 4” Height x full width of counter

E. Sidesplash: Applied- 4” Height x full depth of counter

F. Performance Characteristics:

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<tr>
<th>Property</th>
<th>Typical Result</th>
<th>Test</th>
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<td>Tensile Strength</td>
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<td>Tensile Modulus</td>
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Bowman Development Corp. SOLID SURFACE FABRICATIONS 06 65 10-3
Urban Educational Complex
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<td>ANSI Z124</td>
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<td>No effect</td>
<td>NEMA LD 3-2000</td>
</tr>
<tr>
<td>Wear and Cleanability</td>
<td>Passes</td>
<td>ANSI Z124.3 &amp; Z124.6</td>
</tr>
<tr>
<td>Stain Resistance: Sheets</td>
<td>Passes</td>
<td>ANSI Z124.3 &amp; Z124.6</td>
</tr>
<tr>
<td>Fungus and Bacteria Resistance</td>
<td>Does not support microbial growth</td>
<td>ASTM G21 &amp; G22</td>
</tr>
<tr>
<td>Boiling Water Resistance</td>
<td>No visible change</td>
<td>NEMA LD 3-2000</td>
</tr>
<tr>
<td>High Temperature Resistance</td>
<td>No change</td>
<td>NEMA LD 3-2000</td>
</tr>
<tr>
<td>Izod Impact (Notched Specimen)</td>
<td>0.28 ft.-lbs./in. of notch</td>
<td>ASTM D 256</td>
</tr>
<tr>
<td>Ball Impact Resistance: Sheets</td>
<td>No fracture—1/2 lb. ball:</td>
<td>NEMA LD 3-2000</td>
</tr>
<tr>
<td>Weatherability</td>
<td>$\Delta E^*&lt;5$ in 1,000 hrs.</td>
<td>ASTM G 155</td>
</tr>
<tr>
<td>Specific Gravity †</td>
<td>1.7</td>
<td>ASTM D 570</td>
</tr>
<tr>
<td>Water Absorption</td>
<td>Long-term</td>
<td></td>
</tr>
<tr>
<td>Toxicity</td>
<td>99 (solid colors)</td>
<td>Pittsburgh Protocol Test (&quot;LC50&quot; Test)</td>
</tr>
<tr>
<td>Flammability</td>
<td>All colors</td>
<td>ASTM E 84, NFPA 255 &amp; UL 723</td>
</tr>
<tr>
<td>Flame Spread Index</td>
<td>&lt;25</td>
<td></td>
</tr>
<tr>
<td>Smoke Developed Index</td>
<td>&lt;25</td>
<td></td>
</tr>
</tbody>
</table>

† Approximate weight per square foot: 1/4" (6 mm) 2.2 lbs., 1/2" (12.3 mm) 4.4 lbs. Shapes meet or exceed the ANSI Z124.3 and ANSI Z124.6 standards for plastic sinks and lavatories. NEMA results based on the NEMA LD 3-2000

### 2.3 ACCESSORIES

**A. Joint adhesive:**
1. Manufacturer’s standard one- or two-part adhesive kit to create inconspicuous, nonporous joints.

**B. Sealant:**
1. Manufacturer’s standard mildew-resistant, FDA-compliant, NSF 51-compliant (food zone — any type), UL-listed silicone sealant in colors matching components.

**C. Sink/lavatory mounting hardware:**
1. Manufacturer’s standard bowl clips, panel inserts and fasteners for attachment of undermount sinks/lavatories.

**D. Conductive tape:**
1. Manufacturer’s standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.
E. Insulating felt tape:
   1. Manufacturer’s standard for use with conductive tape in insulating solid surface material from adjacent heat source.

2.4 FACTORY FABRICATION

A. Shop assembly
   1. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer’s printed instructions and technical bulletins.
   2. Form joints between components using manufacturer’s standard joint adhesive without conspicuous joints.
      a. Reinforce with strip of solid polymer material, 2" wide.
   3. Provide factory cutouts for plumbing fittings and bath accessories as indicated on the drawings.
   4. Rout and finish component edges with clean, sharp returns.
      a. Rout cutouts, radii and contours to template.
      b. Smooth edges.
      c. Repair or reject defective and inaccurate work.

2.5 FINISHES

A. As selected from the manufacturer’s standard color chart.

B. Finish: Matte- Gloss range of 5-20

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
   1. Provide product in the largest pieces available.
   2. Form field joints using manufacturer’s recommended adhesive, with joints inconspicuous in finished work.
      a. Exposed joints/seams shall not be allowed.
   3. Reinforce field joints with solid surface strips extending a minimum of 1 inch on either side of the seam with the strip being the same thickness as the top.
   4. Cut and finish component edges with clean, sharp returns.
   5. Rout radii and contours to template.
   6. Anchor securely to base cabinets or other supports.
   7. Align adjacent countertops and form seams to comply with manufacturer’s written recommendations using adhesive in color to match countertop.
   8. Carefully dress joints smooth, remove surface scratches and clean entire surface.
   9. Install countertops with no more than 1/8-inch (3 mm) sag, bow or other variation from a straight line.
B. Applied backsplashes and sidesplashes:
1. Install applied sidesplashes using manufacturer’s standard color-matched silicone sealant.
2. Adhere applied sidesplashes to countertops using manufacturer’s standard color-matched silicone sealant.

C. Integral sinks/counters:
1. Provide solid surface materials bowls and/or lavatories sinks with overflows in locations shown on the drawings.
2. Secure sinks and lavatory bowls to tops using manufacturer’s recommended sealant, adhesive and mounting hardware to maintain warranty.

3.3 REPAIR
A. Repair or replace damaged work which cannot be repaired to architect’s satisfaction.

3.4 CLEANING AND PROTECTION
A. Keep components clean during installation.
B. Remove adhesives, sealants and other stains.

END OF SECTION
DIVISION 7

THERMAL AND MOISTURE CONTROL
PART 1  GENERAL

1.1  SECTION INCLUDES

A.  Surface preparation.
B.  Application of a waterproofing protection course.

1.2  RELATED SECTIONS

A.  Section 03 30 00 - Cast-in-Place Concrete.
B.  Section 07 13 26 - Sheet Waterproofing.
C.  Single Source Requirement:  All products listed below shall be from the same manufacturer.
   1.  Section 07 13 26 – Sheet Waterproofing
   2.  Section 07 26 10 – Below Grade Vapor Retarders
   3.  Section 07 27 26 – Fluid Applied Membrane Air Barriers

1.3  REFERENCES

A.  ASTM D6506 - Standard Specification for Asphalt Based Protection for Below-Grade Waterproofing.

1.4  SUBMITTALS

A.  Comply with Section 01 33 00 - Submittal Procedures.
B.  Submit manufacturer's product data and application instructions.

1.5  DELIVERY, STORAGE, AND HANDLING

A.  Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
B.  Store materials in a clean dry area in accordance with manufacturer's instructions.
C.  Protect materials during handling and application to prevent damage or contamination.
D.  Do not apply protection course over liquid applied waterproofing membranes containing volatile solvents until all of the solvent has evaporated.

1.6  ENVIRONMENTAL REQUIREMENTS

A.  Product not intended for uses subject to abuse or permanent exposure to the elements.
PART 2  PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. W.R. Meadows, Inc. (Basis of Design)
B. W. R. Grace
C. SIKA
D. Substitutions in accordance with Section 01 60 00.

2.2 MATERIALS

A. Protection Course: Multi-ply, semi-rigid board, composed of a mineral-fortified asphaltic core formed between two outside layers of asphalt-impregnated fiberglass mat, weathercoated and covered with a polyethylene anti-stick sheet.
   1. Performance Based Specification: protection course shall have the following characteristics based on ASTM D6506:
      a. Type 1
         1) Puncture Strength, Class A & B: 222 N (50 lbf) minimum.
         2) Thickness, Class A & B: 1.3 mm to 1.8 mm (0.050 to 0.070 inches).
         3) Water Absorption, Class A & B: 10 % maximum.
         4) Asphalt % by weight, Class A: 65 % minimum.
         5) Asphalt % by weight, Class B: 40 % minimum.
         6) Resistance to decay, Class A & B: Meets puncture requirements after completion of test.
      a. PC-1 Light Duty

2.3 ACCESSORIES

A. Joint Tape: Detail Strip by W.R. Meadows.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive protection course. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.2 SURFACE PREPARATION

A. Prior to application, consult the waterproofing manufacturer to determine whether the polyethylene film facing on one side, or the asphalt-impregnated fiberglass mat on the other side of protection course is approved as compatible to the specific waterproofing product being placed.

B. Clean and prepare surfaces to receive protection course in accordance with manufacturer's instructions.
C. If water testing is required, perform prior to application of protection course.

3.3 APPLICATION

A. Horizontal Application
1. Install protection course as soon as permissible by membrane applicator or manufacturer.
2. Butt together all protection course sheet and cut to fit all intersecting surfaces and protrusions.
3. Cover joints with joint tape if desired.
4. Alternatively, cover joints with roofer's glass reinforced tape embedded in hot asphalt. Consult membrane manufacturer regarding this application for compatibility.
5. Ensure wearing surface is applied as soon as possible following protection course application.

B. Vertical Application
1. Install protection course as soon as permissible by membrane applicator or manufacturer.
2. Butt together all protection course sheet and cut to fit all intersecting surfaces and protrusions.
3. If necessary, temporarily hold protection course in place using recommended adhesive by membrane manufacturer.
4. Backfill immediately using care and caution to avoid damage to waterproofing system.
5. Do not drop backfill material against protection course in such a manner that it could drag the sheet down as backfill drops.

3.4 PROTECTION

A. Apply protection course at the end of each day's waterproofing to both horizontal and vertical surfaces.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.
B. Application of rolled, self-adhering waterproofing membrane system.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete.
B. Section 07 21 20 - Board Insulation.
C. Section 07 90 00 - Joint Sealants.
D. Single Source Requirement: All products listed below shall be from the same manufacturer.
   1. Section 07 10 10 – Waterproofing Protection Course.
   2. Section 07 26 10 – Below Grade Vapor Retarder.
   3. Section 07 27 26 – Fluid Applied Membrane Air Barriers.

1.3 REFERENCES

A. American Railway Engineering & Maintenance of Way Association (AREMA) Specification Chapter 29 - Waterproofing.
E. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
I. ASTM E154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
1.4 SUBMITTALS
   A. Comply with Section 01 33 00 - Submittal Procedures.
   B. Submit manufacturer's product data and application instructions.

1.5 DELIVERY, STORAGE, AND HANDLING
   A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
   B. Store materials in a clean dry area in accordance with manufacturer's instructions.
   C. Protect materials during handling and application to prevent damage or contamination.
   D. Do not apply protection course over liquid applied waterproofing membranes containing volatile solvents until all of the solvent has evaporated.

1.6 DELIVERY, STORAGE, AND HANDLING
   A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
   B. Store materials in a clean dry area in accordance with manufacturer's instructions.
   C. Store adhesives and primers at temperatures of 40°F (5°C) and above to facilitate handling.
   D. Store membrane cartons on pallets.
   E. Do not store at temperatures above 90°F (32°C) for extended periods.
   F. Keep away from sparks and flames.
   G. Completely cover when stored outside. Protect from rain.
   H. Protect materials during handling and application to prevent damage or contamination.
   I. Avoid use of products which contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with waterproofing membrane system.

1.7 ENVIRONMENTAL REQUIREMENTS
   A. Product not intended for uses subject to abuse or permanent exposure to the elements.
   B. Protect rolls from direct sunlight until ready for use.
   C. Do not apply membrane when air or surface temperatures are below 40°F (4°C).
D. Do not apply to frozen concrete.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. W.R. MEADOWS, Inc.
B. W.R. GRACE
C. SIIA
D. Substitutions in accordance with Section 01 60 00.

2.2 MATERIALS

A. Rolled, Self-Adhering Waterproofing Membrane: Polymeric waterproofing membrane protected by release paper on cross-laminated polyethylene carrier film with exposed polymeric membrane strips on both sides protected by pull-off release strips.

1. Performance Based Specification: Waterproofing membrane shall have the following characteristics:
   b. Thickness:
      1) Carrier Film: 4 mils.
      2) Polymeric Membrane: 56 mils.
   c. Tensile Strength, ASTM D412, Die C:
      1) Carrier Film: 5,900 psi (40.71 MPa) minimum.
      2) Polymeric Membrane: 460 psi (3.23 MPa) minimum.
   d. Elongation, ASTM D412, Die C: Polymeric Membrane: 971% minimum.
   e. Peel Adhesion, ASTM D903: 11.8 lbf/in. (2068 N/m).
   f. Lap Adhesion, ASTM D1876: 8.62 lbf/in. (1508 N/m)
   g. Water Vapor Permeability, ASTM E96, Method B: 0.036 perms.
   h. Water Absorption, ASTM D570: 0.1 percent, 72 hours maximum.
   i. Resistance to Hydrostatic Head: Equivalent to 230.9 feet (70.3 m) of water.
   k. Exposure to Fungi, Soil Test: Pass, 16 weeks.
   l. Color:
      1) Carrier Film: White.
      2) Polymeric Membrane: Black.

   a. MEL-ROL: For use at temperatures of 40°F (4°C) and above.
   b. Alternate MEL-ROL products may be substituted based on air and surface temperature at time of application.

2.3 ACCESSORIES

A. Surface Conditioner:
   1. Temperatures Above 40°F (4°C): Mel-Prime Water Base Primer.
2. Temperatures Above 0°F (-18°C): Mel-Prime VOC Compliant Solvent Base Primer or Standard Solvent Base Primer.

B. Flashing and Fillets: MEL-ROL LIQUID MEMBRANE.

C. Pointing Mastic: POINTING MASTIC.

D. Termination Bar: TERMINATION BAR.

E. Corner Tape: DETAIL STRIP.

F. Waterproofing Protection Course: PROTECTION COURSE


PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive self-adhering membrane. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.2 SURFACE PREPARATION

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

C. Do not apply waterproofing to surfaces unacceptable to manufacturer.

D. Concrete surfaces must be clean, smooth and free of standing water.

E. Patch all holes and voids and smooth out any surface misalignments.

F. Apply surface conditioner to surfaces that will be covered within one working day according to manufacturer’s recommended coverage rates.

G. Install corner tape on all inside and outside corners, including the footing.

H. Apply a 9” (229 mm) strip of self-adhering membrane over construction, control and expansion joints and over cracks greater than 1/16” (1.59 mm) wide.

I. Seal all terminations with pointing mastic.

3.3 APPLICATION

A. Horizontal Application

1. Apply waterproofing membrane system in accordance with manufacturer's instructions.

2. Ensure accessory materials are compatible with membrane and approved by membrane manufacturer.
3. Remove release paper on edge, then position the membrane.
4. Pull balance of release paper off, running the roll from low to high points, so all laps will shed water.
5. Immediately hand-rub the membrane firmly to the surface, removing any bubbles or wrinkles, then pressure roll the complete surface to assure positive adhesion.
6. Stagger end laps and overlap all seams at least 2 ½” (63.5 mm).
7. Seal all terminations with pointing mastic.
8. Inspect membrane before covering and repair as necessary. Cover tears and inadequate overlaps with membrane. Seal edges of patches with pointing mastic.
9. Perform flood testing of horizontal applications, as required. Mark leaks and repair when membrane dries.

B. Vertical Application
1. Apply waterproofing membrane system in accordance with manufacturer's instructions.
2. Ensure accessory materials are compatible with membrane and approved by membrane manufacturer.
3. Remove release paper on edge and position the membrane.
4. Pull balance of release paper off, running the roll vertically over the top of the corner tape at the footing.
5. Immediately hand-rub the membrane firmly to the surface, removing any bubbles or wrinkles, then pressure roll the complete surface to assure positive adhesion.
6. Overlap all seams and stagger end laps at least 2 ½” (63.5 mm).
7. Seal all terminations with pointing mastic.
8. Inspect membrane before covering and repair as necessary. Cover tears and inadequate overlaps with membrane. Seal edges of patches with pointing mastic.

3.4 PROTECTION
A. Protect membrane on vertical and horizontal applications with immediate application of waterproofing protection course, rolled matrix drainage board.
B. Backfill immediately using care to avoid damaging waterproofing membrane system.

END OF SECTION
SECTION 07 21 00 - THERMAL INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Foam-plastic board insulation.
   2. Glass-fiber blanket insulation.
   4. Vapor retarders.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
C. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.3 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.
B. Submit manufacturer's product data and application instructions.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
B. Store materials in a clean dry area in accordance with manufacturer's instructions.
C. Protect materials during handling and application to prevent damage or contamination.
D. Do not apply protection course over liquid applied waterproofing membranes containing volatile solvents until all of the solvent has evaporated.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
B. Protect foam-plastic board insulation as follows:
   1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
   3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION (RIGID INSUL)

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. DiversiFoam Products.
      b. Dow Chemical Company (The).
      c. Owens Corning.
      d. Pactiv Building Products.
      e. Or approved equal.
   2. Type X, 15 psi.

B. Unfaced Wall Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type IV, 25-psi minimum compressive strength; unfaced; fabricated with shiplap or channel edges and with one side having grooved drainage channels.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. DiversiFoam Products.
      b. Dow Chemical Company (The).
      c. Pactiv Building Products.
      d. Or approved equal.

C. Foil-Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 2, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      b. Dow Chemical Company (The).
      c. Rmax, Inc.
      d. Or approved equal.

D. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
2.2 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. CertainTeed Corporation.
   2. Johns Manville.
   3. Owens Corning.
   4. Or approved equal.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Foil-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type II (non-reflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).

D. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:
   1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
   2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

2.3 MINERAL-WOOL BLANKET INSULATION (SOUND ATTENUATION)

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Fibrex Insulations Inc.
   2. Owens Corning.
   3. Thermafiber.
   4. Or approved equal.

B. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

2.4 VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils thick, with maximum permeance rating of 0.13 perm.

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

D. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.
E. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

2.5 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
      b. Gemco; Spindle Type.
      c. Or approved equal.
   2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.

B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Gemco; 90-Degree Insulation Hangers.
      b. Or approved equal.
   2. Angle: Formed from 0.030-inch-thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
   3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.

C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. AGM Industries, Inc.; RC150.
      b. Gemco; R-150.
      c. Or approved equal.
   2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
      a. Where indicated.
PART 3 EXECUTION

3.1 PREPARATION
A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL
A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BELOW-GRADE INSULATION
A. On vertical footing and foundation wall surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.

3.4 INSTALLATION OF CAVITY-WALL INSULATION
A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.
1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Division 04 Section "Unit Masonry."

3.5 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION
A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
B. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings and seal each continuous area of insulation to ensure airtight installation.
   a. Exterior Walls: Set units with facing placed toward interior of construction.

C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
   1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
   2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.6 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions.

3.7 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
   1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
   2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
   3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
   4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.8 INSTALLATION OF CURTAIN-WALL INSULATION

A. Install board insulation in curtain-wall construction where indicated on Drawings according to curtain-wall manufacturer's written instructions.
   1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated between insulation and glass.
   2. Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.
3.9 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.
   1. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c. Before installing vapor retarders, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
   2. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.10 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION
PART 1 — GENERAL

1.01 SECTION INCLUDES

A. Cover board and polyisocyanurate roof board types and applications. Roof section application and layout requirements.

1.02 RELATED DOCUMENTS

A. Drawings and contract documents, including Section 01 10 00 - Summary, apply to this section.

1.03 RELATED SECTIONS

A. Section 01 10 00 - Summary
B. Section 01 60 00 - Product Requirements
C. Section 01 73 00 - Execution Requirements
D. Section 02 22 10 - Building Demolition
E. Section 05 50 00 - Metal Fabrications
F. Section 06 11 40 - Wood Blocking and Curbing
G. Section 07 52 20 - Hybrid Composite Built-Up Asphalt Roofing
H. Section 07 54 10 - Thermoplastic Membrane Roofing
I. Section 07 71 00 - Manufactured Roof Specialties
J. Section 07 90 00 - Joint Sealers

1.04 REFERENCES

A. ASTM C 208 Cellulose Fiber Insulating Board
B. ASTM C 1289 Polyisocyanurate Insulating Board
C. UL Roofing and Materials Directory 2003, Underwriters Laboratories Inc.
D. Factory Mutual Global – Approval Guide

1.05 SUBMITTALS

A. Contractor shall provide at Pre-Construction meeting approved insulation samples. Product data sheets shall accompany samples, MSDS sheets shall match the name on the product data submitted.
1. Polyisocyanurate insulation board
2. Manufacturer’s tapered insulation plan per roof section.
3. Cover board as approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials:
1. Deliver materials to job-site in new, dry, unopened and well-marked containers showing product and manufacturers name.
2. Deliver materials in sufficient quantity to allow continuity of work.
3. Coordinate delivery with project superintendent.
4. Do not order project materials or start work before receiving written notice to proceed. No work shall commence without signed contracts.
5. The facilities staff shall not sign any material deliveries.

B. Storage of Materials:
1. Store rolled goods on ends only. Place materials on pallets. Do not stack pallets.
2. Store materials marked “KEEP FROM FREEZING” in areas where temperatures will remain above 40º F.
3. For insulation, remove plastic packaging shrouds. Cover top and sides of all stored materials with tarpaulin (not polyethylene). Secure tarpaulin.
4. Rooftop storage: Disperse material to avoid concentrated loading.
5. Do not store materials in open or in contact with ground or roof surface.
6. Store all materials on a raised platform covered with secured canvas tarpaulin (not polyethylene), top to bottom. Cover all materials when project is not in progress and maintain the ability at all times to cover the materials when required, such as during an unanticipated rain shower.
7. Contractor shall assume full responsibility for the protection and safekeeping of products stored on premises.

C. Material handling:
1. Handle materials to avoid bending, tearing, or other damage during transportation and installation.
2. Material handling equipment shall be selected and operated so as not to damage existing construction or applied roofing. Do not operate or situate material handling equipment in location that will hinder smooth flow of vehicular or pedestrian traffic.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Environmental requirements:
1. Do not work in rain, snow, or in presence of water and high wind conditions.
2. Do not work in temperatures below 40º F.
3. Do not install materials marked “KEEP FROM FREEZING” when daily temperatures are scheduled to fall below 40º F.

B. Remove any work exposed to freezing.
1. Advise Owner when volatile materials are to be used near air ventilation intakes so Owner can use some or all of the following methods to minimize disruptions to building occupants and operations:
   a. Divert air intake from work area by attaching scoops or temporary ductwork.
   b. Temporarily shut down or block air intakes.
PART 2 — PRODUCTS

2.01 GENERAL

A. Comply with quality control, references, specifications, and manufacturer's data. Products containing asbestos are prohibited on this project. Use only asbestos-free products.

B. Use products with personal protection. User must read container label and material safety data sheets prior to use.

2.02 ACCEPTABLE MANUFACTURERS

A. Use only approved Polyisocyanurate board. Acceptable manufacturers include:
   1. Hy-Therm AP by Celotex
   2. ENERGY-2 by Johns Manville
   3. ISO95+GL by Firestone
   4. AC Foam-II by Atlas
   5. Approved equal by Owner.

B. Cover board.
   2. DensDeck/Prime Sheathing.

2.03 MATERIALS

A. Base, Tapered and Flat Polyisocyanurate Board Insulation:
   1. FS HH-I-1972 (1) Class 1, factory-tapered polyisocyanurate.
   2. Black, glass fiber reinforced, non-asphaltic facer
   3. Dimensions: 4 by 4 feet x minimum 1 inch min. thickness. For existing decks start at 2 inch minimum unless noted otherwise.
      a. The insulation thickness shall be adjusted as required to meet or exceed the roof insulation systems specified R-Value requirement (R30 avg).
   4. Tapered polyisocyanurate insulation will be installed as a 4-way tapered layout or as shown on roof drawing.
   5. Provide factory-tapered insulation boards fabricated to the following slopes:
      a. 1/4-inch rise per 12 inch run
      b. At existing deck areas as shown on the plans at 1/8-inch rise per 12 inch run where noted or when existing deck has 1/8-inch slope integral with structure.
   6. Provide flat stock insulation boards for steep slopes in decks of ¼ inch per foot slope or more.
      a. Provide at minimum 2 layers to achieve R30 R-value. The first layer shall be at least 2 inches thick, fully adhered; and a second layer adhered to the first layer to achieve R-value.

B. Tapered Polyisocyanurate Saddle and Cricket Insulation:
   1. FS HH-I-1972 (1) Class 1, tapered polyisocyanurate.
   2. Black, glass fiber reinforced, non-asphaltic facer
   3. Dimensions: 4 by 4 feet.
   4. Provide factory-tapered insulation boards fabricated to slope of twice (2 times) the roof system slope, with a minimum of 1/2 inch per foot.

C. Nail Board (Metal Roofing Areas): (N/A)
   1. Similar to Article A1.02 (one side) with 7/16 oriented strand board adhered to one side.
2. Use base insulation as first layer to achieve min. R-30.
3. Board Size: 48 x 96

D. Cover Board (Single Ply Membrane):
   1. Gypsum based cover board, 0.25 inch, R-value – Negligible.
   2. Dimensions: 4 x 4 feet, non-combustible, water resistant gypsum core with embedded glass mat facers complying with ASTM C1177.

E. Tapered Edge Strips: ASTM C 208, asphalt-coated fiberboard, tapered from 1-5/8 inch to 1/8 inch; dimensions: 12” x 48”.

F. Fibered Cant Strips:
   1. ASTM C 208-95, asphalt-coated fiberboard, factory fabricated.
   2. Dimensions: 4 by 4 inch cut on bias.

G. Insulation Roof Board Adhesive: 2 part low-rise foam adhesive.

H. Insulation Adhesive Primer: Low-VOC, water-based, polymer modified asphalt primer. As recommended by system manufacturer.

I. Roof insulation accessories: As recommended by insulation manufacturer for intended use and compatible with membrane roofing.

PART 3 — EXECUTION

3.01 EXAMINATION

A. Verify conditions as satisfactory to receive work.

B. Do not begin roofing until all unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions.

C. Verify that work of other trades penetrating existing roof deck or requiring men and equipment to traverse existing roof deck has been approved by Owner, manufacturer, and roofing contractor.

D. Check existing projections, curbs, and deck for inadequate anchorage, foreign material, moisture, or unevenness that would prevent quality and execution of new roofing system.

3.02 GENERAL WORKMANSHIP

A. All work performed by contractor shall conform to this specification.

B. The presence and activity of the manufacturer's representative, architect's representative, and/or Owner's representative shall in no way relieve contractor of contract responsibilities or duties.

C. Substrate: Free of foreign particles prior to laying roof insulation.

D. Wrapper and packaging materials: Not to be included in roofing system.

E. Insulation: Form continuous insulation joints over existing decking.

F. Install insulation boards in courses parallel to roof edges.
G. Firmly butt each insulation board to surrounding boards. Do not jam or deform boards.

H. Eliminate open joints and uneven surfaces.
   2. Fill insulation board joint gaps larger than 1/4 inch with roof insulation.

I. Cut and fit insulation boards where roof deck intersects vertical surfaces. Cut board 1/4 inch from vertical surface.

J. Stagger joints at least 6 inches.

K. Filler size: 18 inches in length or width, minimum.

3.03 PREPARATION

A. Protection:
   1. Contractor shall be responsible for protection of property during course of work. Lawns, shrubbery, paved areas, and building shall be protected from damage. Repair damage and/or clean marred areas at no extra cost to owner.
   2. Provide at site prior to commencing removal of debris, a dumpster or dump truck to be located adjacent to building where directed by owner.
   3. Roofing, flashings, membrane repairs, and insulation shall be installed and sealed in a watertight manner on same day of installation or before arrival of inclement weather.
   4. At start of each work day drains within daily work area shall be plugged. Plugs to be removed at end of each workday or before arrival of inclement weather. Preparation work shall be limited to those areas that can be covered with installed roofing material on same day and before arrival of inclement weather.
   5. Arrange work sequence to avoid use of newly constructed roofing for storage, walking surface, and equipment movement. Move equipment and ground storage areas as work progresses.
   6. Protect building surfaces at set-up areas with tarpaulin. Secure tarpaulin. Remove dumpster from premises when full and empty at approved dumping or refuse area. Deliver empty dumpster to site for further use. Upon job completion, dumpster shall be removed from premises. Spilled or scattered debris shall be cleaned-up immediately. Removed material to be disposed from roof as it accumulates.
   7. At end of each working day, seal removal areas with water stops along edges to prevent water entry.
   8. Provide clean plywood walkways and take other precautions required to prevent tracking of aggregate/debris from existing membrane into new work area where aggregate/debris pieces can be trapped within new roofing membrane. Contractor shall instruct and police workmen to ensure that aggregate/debris is not tracked into new work areas on workmen's shoes or equipment wheels. Discovery of entrapped aggregate/debris within new membrane is sufficient cause for its rejection.

B. Surface preparation:
   1. Remove existing roofing and insulation to existing roof deck.
   2. Sweep clean existing roof deck.
   3. Install pressure treated wood nailers as required to match new insulation height.
   4. Install slip and base sheet nailed prior to insulation application at cementitious wood fiber or gypsum concrete deck per Section 07 54 10.
   5. Install backnailing 2x at 10'-0” o.c. on steep sloped deck areas. Per manufacturer’s NRCA acceptable roofing standards.
6. Install self-adhering vapor barrier membrane, waterproof, lap min. 3”. Prime surface prior to installation if required by roofing system manufacturer.

3.04 INSTALLATION

A. Install new tapered roof insulation system. Comply with built-up roofing manufacturer’s written instructions for installing roof insulation.

1. General Requirements:
   a. The minimum insulation average R-Value requirement for the project is R-30. The installed insulation thickness shall be adjusted as required to meet or exceed the roof insulation systems specified R-Value requirement min. thickness.
   b. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards.
   c. Fill gaps exceeding 1/4 inch with insulation.
   d. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
   e. Install insulation system in application 2-part low-rise foam adhesive with beads at 4” o.c. per manufacturer’s recommendations. Walk insulation boards into adhesive immediately after placement to achieve solid contact. Roll insulation with weighted rollers to achieve solid contact.
   f. Install insulation under area of roofing to achieve required thickness.
      Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
   g. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
   h. At steep slope conditions, provide 2x wood blocking at 10 foot spacings on center for backnailing. Total height to match insulation thickness. Note blocking shall run horizontally across slope with cap sheets running perpendicular to slope.

B. Install base and tapered polyisocyanurate insulation system.

1. Install tapered polyisocyanurate insulation with 1/4 inch per foot slope except where 1/8 inch per foot slope is shown.
2. Minimum insulation thickness as required to meet the specified insulation system R-Value requirement.
3. Install 4 by 4 ft. tapered insulation sumps at roof drain locations and 2 by 2 ft tapered insulation sumps at scupper locations (excluding overflow roof drains and scuppers).
4. Adhere tapered insulation layers, tapered edge and cant strips in application of 2 part low-rise foam adhesive. Walk boards into adhesive immediately after installation to achieve solid contact. Rolled with weighted roller.

C. Install base flat/tapered insulation layer. Refer to Section 07 54 10.

1. At existing Cementitious Wood Fiber or Gypsum Concrete Deck (if applicable):
   a. Adhere insulation to base sheet surface with a uniform and continuous bead at 4” o.c. of 2-part low-rise foam adhesive.
2. At Existing and New Metal Deck Areas: Adhere insulation to waterproof vapor barrier. Install first layer of insulation to deck using set in 2-part low-rise foam adhesive specifically designed and sized for fastening specified board-type roof insulation to vapor barrier.
   a. Remove existing insulation by backing out each metal fastener and removing the insulation.
b. Clean roof deck and wall surfaces of dust, debris and other substances detrimental to roofing installation according to roof system manufacturer’s written instruction. Remove sharp protections. Sweep deck clean prior to installing new roof system. Tape all holes with manufacturer approved reinforced tape.

c. Adhere new insulation in 2-part low-rise foam insulation adhesive.
   1) Fasten first layer of insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
   2) Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.

d. Install all subsequent layers with 2-part low-rise foam adhesive with beads at 4” o.c.
   1) Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.

D. Install tapered insulation saddles and install tapered insulation saddles or crickets to promote positive drainage along valley lines between roof drains and scuppers, along walls, at high side of roof curbs and as instructed at Pre-Construction Meeting.
   1. Install tapered polyisocyanurate insulation with minimum 1/2-inch per foot slope.
   2. Tapered insulation saddle and cricket slope shall equal a minimum of twice the roof slope.
   3. Saddle widest width shall equal or exceed 1/3 of the distance between the roof drains or scuppers.
   4. Contractor is responsible for the elimination of ponding water along valley lines.
   5. Adhere tapered insulation to base tapered insulation layer with application of insulation adhesive of 2 part low-rise foam adhesive. Walk board into adhesive then roll with weighted roller.

E. Install insulation on steep slopes similar with the use of 2 layers of insulation to meet the min R-value with Type IV asphalt.

F. Install appropriate cover boards for system to be installed over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck. Tape joints if required by roofing manufacturer.
   1. Fasten cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
   2. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.
   3. Adhere in 2 part low-rise foam adhesive with beads at 4” o.c. Immediately walk boards into adhesive and roll with 75 lb weighted roller.
   4. For gypsum based cover, provide ¼” space between boards.

G. Install tapered edge strips.
   1. Install tapered edge strips where blocking height exceeds insulation height.
   2. Adhere tapered edge strips over top layer insulation with application of beads at 4” o.c. of insulation adhesive.

H. Install fibered cant strips.
   1. Adhere 45 degrees and continuous cants (4 by 4's) at intersections of horizontal and vertical flashing surfaces with application of beads at 4” o.c. of insulation adhesive.

END OF SECTION
PART 1  GENERAL

1.1  SECTION INCLUDES

A. Surface preparation.
B. Application of an underslab vapor retarder.

1.2  RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete.
B. Section 07 13 26 - Self Adhering Sheet Waterproofing.
C. Section 09 65 00 - Resilient Flooring.
D. Section 09 68 80 - Carpet-Glue Down
E. Single Source Requirement: All products listed below shall come from the same manufacturer.
   1. Section 07 10 10 – Waterproofing Protection Course.
   2. Section 07 13 26 – Sheet Waterproofing.
   3. Section 07 27 26 – Fluid Applied Membrane Air Barriers.

1.3  REFERENCES

C. ASTM E154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs.
D. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
E. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

1.4  SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.
B. Submit manufacturer's product data and application instructions.
1.5 QUALITY ASSURANCE
   A. Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the vapor retarder.
   B. Obtain vapor retarder materials from a single manufacturer regularly engaged in manufacturing the product.
   C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

1.6 PRECONSTRUCTION MEETING
   A. Pre-Construction Meeting: Convene one week prior to installation of underslab vapour retarder. Attendees to be as follows: - Architect, Engineer, General Contractor, Vapor Retarder Installer, and Vapor Retarder Manufacturer to discuss the application in detail.

1.7 DELIVERY, STORAGE, AND HANDLING
   A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
   B. Store materials in a clean, dry area in accordance with manufacturer's instructions.
   C. Protect materials during handling and application to prevent damage or contamination.
   D. Ensure membrane is stamped with manufacturer’s name, product name, and membrane thickness at intervals of no more than 85” (220 cm).

1.8 ENVIRONMENTAL REQUIREMENTS
   A. Product not intended for uses subject to abuse or permanent exposure to the elements.
   B. Do not apply on frozen ground.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
   A. W. R. MEADOWS, INC
   B. W.R. GRACE.
   C. SIKA
   D. Substitutions in accordance with Section 01 60 00.

2.2 MATERIALS
   A. Plastic Vapor Retarder
1. Performance-Based Specification: Vapor retarder membrane shall be manufactured from virgin polyolefin resins and shall meet or exceed all requirements of ASTM E1745, Class A.
   a. Maximum Water Vapor Permeance (ASTM E154 Sections 7, 8, 11, 12, 13, by ASTM E96, Method B or ASTM F1249)
      i. As received: 0.0183 perms.
      ii. After Wetting and Drying: 0.0219 perms.
      iii. Resistance to Plastic Flow and Temperature: 0.0197 perms.
      iv. Effect Low Temperature and Flexibility: 0.0212 perms.
      v. Resistance to Deterioration from Organisms and Substances in Contacting Soil: 0.0198 perms.
   c. Tensile Strength ASTM E154, Section 9: 52 Lb. Force/Inch

2. Proprietary-Based Specification:
   a. PERMINATOR 10 mil by W. R. MEADOWS.

2.3 ACCESSORIES

A. Plastic Vapor Retarder
   1. Seam Tape
      a. High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 4” (100 mm).
   2. Pipe Collars
      a. Construct pipe collars from vapor retarder material and pressure sensitive tape per manufacturer’s instructions.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. Prepare surfaces in accordance with manufacturer’s instructions.
B. Level, tamp, or roll earth or granular material beneath the slab base.

3.2 EXAMINATION

A. Examine surfaces to receive membrane. Notify architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.3 APPLICATION

A. Install the vapor retarder membrane in accordance with manufacturer’s instructions and ASTM E1643–98.
B. Unroll vapor retarder with the longest dimension parallel with the direction of the pour.
C. Lap vapor retarder over footings and seal to foundation walls.
D. Overlap joints 6” (152 mm) and seal with manufacturer’s tape.
E. Seal all penetrations (including pipes) with manufacturer’s pipe boot.

F. No penetration of the vapor retarder is allowed except for reinforcing steel and permanent utilities.

G. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6’’ (152 mm) and taping all four sides with tape.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.
B. Application of liquid applied asphalt emulsion air/vapor barrier.
C. Application of materials to provide bridge and seal air leakage pathways in
   1. Wall and roof connections and penetrations.
   2. Connections to foundation walls.
   3. Walls, windows, curtain walls, storefronts, louvers or doors
   4. Expansion and control joints.
   5. Masonry ties.
   6. All other penetrations through the wall assembly.

1.2 RELATED SECTIONS

A. Section 04 81 00 - Unit Masonry Assemblies.
B. Section 07 21 00 - Thermal Insulation.
C. Section 07 71 00 - Manufactured Roof Specialties.
D. Section 07 90 00 - Joint Sealers.
E. Section 08 11 00 - Steel Doors and Frames.
F. Section 08 41 00 - Aluminum Entrances and Storefronts.
G. Section 08 44 00 - Aluminum Curtain walls
H. Section 09 26 00 - Gypsum Board Systems.
I. Single Source Requirement: All products listed below shall come from the same manufacturer.
   1. Section 07 10 10 – Waterproofing Protection Course.
   2. Section 07 13 26 – Sheet Waterproofing.
   3. Section 07 26 10 – Below Grade Level Retarders.

1.3 REFERENCES

C. ASTM E96-00e1 (Method B) - Standard Test Methods for Water Vapor Transmission of Materials.


F. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference.


1.4 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Submit manufacturer's product data and application instructions.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Air Barrier Installer shall be currently accredited under the Air Barrier Association of America (ABAA) and ensure applicators are certified in accordance with the ABAA Quality Assurance Program.

B. Obtain air/vapor barrier materials from a single manufacturer regularly engaged in manufacturing the product.

C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

1.6 PRECONSTRUCTION MEETING

A. Preconstruction Meeting: Convene one week prior to commencing Work of this section, in accordance with Section 01 31 00.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean dry area in accordance with manufacturer's instructions.

C. Store at temperatures above 32°F (0°C), free from contact with cold or frozen surfaces.

D. Protect materials during handling and application to prevent damage or contamination.
1.8 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.

B. Do not proceed with product application during rain or inclement weather.

C. Do not apply membrane when air or surface temperatures are below 30°F (-1°C).

D. Do not apply to frozen substrate.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. W. R. Meadows, Inc.

B. W. R. Grace.

C. SIKA.

D. Substitutions in accordance with Section 01 60 00.

2.2 MATERIALS

A. Liquid Air Vapor Barrier System: One component, polymer modified, cold applied liquid air/vapor barrier membrane.
   1. Performance Based Specification: Air/vapor barrier membrane shall be an elastomeric asphalt emulsion having the following characteristics:
      a. Air Permeability ASTM E2357: 0.04 cfm / ft² @ 75 Pa (1.57 lbs / ft²).
      b. Air Permeability ASTM E2178: 0.004 cfm / ft² @ 75 Pa (1.57 lbs / ft²).
      c. Water Vapor Permeance ASTM E96 (Method B): ≤0.1 perms.
      d. Elongation ASTM D412: 1500 %.
      e. Tensile Strength ASTM D412: 15 psi.

2.3 ACCESSORIES

A. Flashing and Transition Membrane: Self adhesive polymeric air/vapor barrier membrane having a thickness of 40 mils (1 mm).
   1. AIR-SHIELD THRU-WALL FLASHING by W. R. MEADOWS.

B. Detailing Compound: Single component joint filler for exterior sheathing panels.
   1. AIR SHIELD JOINT FILLER by W.R. MEADOWS.

C. Liquid Flashing: Fluid applied, single component, flashing membrane for rough openings.
   1. AIR SHIELD LIQUID FLASHING by W.R. MEADOWS.

D. Joint Tape: Self adhesive polymeric membrane for joints of plywood and oriented strand board (OSB).
   1. AIR SHIELD by W.R. MEADOWS.
E. Primer:
1. Temperatures above 40°F (4°C): Water Based Primer
   a. MEL-PRIME™ W/B Water Base Primer by W. R. MEADOWS.
2. Temperatures below 30°F (-1°C): Solvent Based Primer.
   a. MEL-PRIME VOC Compliant Solvent-Base Primer or Standard Solvent-Base Primer by W. R. MEADOWS.

F. Pointing Mastic: mastic for sealing penetrations and terminations of membrane.
1. POINTING MASTIC by W.R. MEADOWS.

G. Concrete Repair Materials: general purpose patching materials.
1. MEADOW-PATCH™ 5 and 20 Concrete Repair Mortars by W.R. MEADOWS.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive membrane. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.2 SURFACE PREPARATION

A. Protect adjacent surfaces not designated to receive air/vapor barrier.

B. Clean and prepare surfaces to receive air/vapor barrier membrane in accordance with manufacturer's instructions.

C. Do not apply membrane to surfaces unacceptable to manufacturer.

D. Concrete surfaces must be clean, free of standing water, ice, snow, frost, dust, dirt, oil, curing compounds or any other foreign material that could prevent proper adhesion of the membrane.

E. Patch all holes and voids and smooth out any surface misalignments.

F. Patch all cracks, protrusions, small voids, offsets, details, irregularities and small deformities with cementitious patching mortar at least two hours before application.

G. Ensure joints between dissimilar building materials are sealed with a strip of self-adhesive membrane 6” (150 mm) wide, centered over the joint.

H. Exterior Sheathing Panels:
1. Install and fasten exterior sheathing panels according to the sheathing manufacturer’s instructions.
2. Treat all countersunk and removed fasteners with joint filler or liquid flashing material.
3. Inspect the joint to ensure that all areas to receive joint treatment are clean, dry, smooth, and free from all bond-breaking contaminants.
4. Remove and replace any damaged structural wall components.
5. Joint Treatment using joint filler
   a. Fill joint area with joint filler using a spreader tool or 3” putty knife.
b. Extend the joint filler beyond the joint line 3” onto face of exterior sheathing.

c. Fully embed 3” wide reinforcing fabric into the wet joint filler, centered over the joint.

d. Run the spreader tool or putty knife over the embedded reinforcing fabric to remove any air bubbles.

I. Plywood and Oriented Strand Board (OSB):
   1. Boards are to be fastened according to board manufacturer.
   2. Apply self-adhesive membrane over all joints.

3.3 APPLICATION OF AIR BARRIER SYSTEM

A. Transition Membrane
   1. Prime surfaces to be covered in one working day with applicable primer.
   2. Apply transition membrane with a minimum overlap of 3” (75mm) onto primed surface at all joints, columns, beams and dissimilar materials.
   3. Roll membrane firmly into place.
   4. Ensure membrane is fully adhered and remove all wrinkles and fish mouths.
   5. Overlap subsequent courses of membrane a minimum of 2” (50 mm) and ensure joints are fully adhered.
   6. Seal top edge of transition membrane with pointing mastic.

B. Rough Opening Transition Membrane
   1. Fluid Applied Transition Membrane using liquid flashing membrane
      a. Apply a coat of primer on the raw edges of exterior gypsum board.
      b. Treatment of joints or cracks larger than ¼” (6.35mm) and less than ½” (12.7mm).
         i. Prefill any joints or cracks with the liquid flashing material.
         ii. Apply a generous bead of material over the joint.
         iii. Press, and spread liquid flashing into the joint.
         iv. Allow material to skin over prior to full application of liquid flashing into the rough opening.
      c. Treatment of joints or cracks larger than ½” (12.7mm)
         i. Install backer rod into the joint to control depth of liquid flashing material.
         ii. Apply a generous bead of material over and into the joint.
         iii. Press, and spread liquid flashing into the joint.
         iv. Smooth out using a spreader tool or putty knife
         v. Allow material to cure prior to full application of liquid flashing into the rough opening.
      d. Apply a bead of liquid flashing in the rough opening starting at the top and continuing around the rough opening.
      e. Spread the material using a spreader tool or putty knife across the rough opening surface.
      f. Test the material thickness using a wet mil gauge to ensure that it has a thickness of 12-15 mils.
      g. Apply a generous bead of liquid flashing material to the vertical surface around the rough opening and spread this material 4” – 6” (100 – 152 mm) onto the vertical surface with a spreader tool or putty knife.
      h. Test the thickness to ensure the material has a thickness of 12-15 mils.
      i. Allow liquid flashing material to dry before installing any windows, doors, wall assembly, and full air barrier material.
B. Through Wall Flashing
   1. Prime surfaces to be covered in one working day with applicable primer.
   2. Remove release paper prior to application.
   3. Apply through wall flashing at base of masonry walls as indicated on drawings.
   4. Recess through wall flashing 1/2” (13 mm) from the face of the masonry.
   5. Apply a bead of pointing mastic if through wall flashing is not embedded into masonry.

C. Air Barrier Membrane
   1. Apply air/vapor barrier membrane in accordance with manufacturer's instructions.
   2. Thoroughly mechanically mix membrane prior to application.
   3. Apply membrane by spray or roller at a minimum coverage rate of 20-25 ft²/gal. (60 mils wet, 45 mils dry). Two coats (30 mils wet) may be necessary.
   4. Frequently inspect surface area with a wet mil gauge to ensure consistent thickness.
   5. Work material into any fluted rib forming indentations.
   6. Cured thickness of membrane should be 45 mils dry.
   7. Avoid use of products which contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with air/vapor barrier system.

3.4 PROTECTION

A. Cover air/vapor barrier membrane as soon as possible, since it is not designed for permanent exposure.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Smooth Insulated Aluminum Wall and Soffit Panels.
   2. Attachment Clips.
   4. Aluminum Extrusions for Panel System.

1.2 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum Wall Panel System shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Performance: Aluminum Wall Panel System shall withstand the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
   1. Wind Loads: Determine loads based on the following minimum design wind pressures:
      a. Uniform pressure as indicated on Contract Drawings.
   2. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/180 of the span.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

C. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop-, and field-assembled work.
   1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
      a. Flashing and trim.
      b. Anchorage systems.
D. Samples for Initial Selection: For each type of metal wall panel indicated with factory-applied color finishes.
   1. Include similar Samples of trim and accessories involving color selection.
   2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Metal Wall: Size as detailed. Include fasteners, battens, closures, and other metal wall panel accessories.

F. Qualification Data: Installer must submit documentation that they are familiar with the specified or approved system and have complete similar installations comparable in size and product.

G. Warranties: Sample of special warranties.

H. Mockup: Provide a 2’ x 2’ x 1’ mockup sample that indicates corner and joint.

I. Submit test reports conducted by a qualified independent testing laboratory to certify compliance with specified quality and performance standards.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer. Install to provide letter of approval from panel manufacturer.

B. Source Limitations: Obtain each type of aluminum wall panel system from single source from a single manufacturer.

C. Preinstallation Conference: Conduct conference at Project Site.
   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
   3. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   4. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.

D. Panel composition including core thickness and skin thickness shall be as required to resist a wind load of 30 PSF positive and negative loading and a deflection limit of L/180, with a maximum of \( \frac{3}{4} \)” when tested in accordance with ASTM E330, “Structural Design Load”.

E. Panels shall provide a “U” value of not greater than .071 BTU for 2” thick panels when tested in accordance with ASTM C236.

F. Panels shall be designed in a manner that, when properly erected, the assembled panels shall have an air leakage rate not 6.24 lbs. per sq. ft. wind load, not to exceed .06 CFM per sq. ft. when tested in accordance with ASTM E283.
G. Panels shall be designed in a manner that, when properly erected, the assembled exterior sheets shall have no uncontrolled infiltration at 7.0 lbs. per sq. ft. when tested in accordance with ASTM E331.

H. The wall shall be so constructed as to provide for expansion and/or contraction of component materials as will be caused by an ambient temperature ranging from 0°F. without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects to the panel system of adjacent building systems, or warping of faces of the panel system.

I. Panels shall be laminated under heat and pressure utilizing an elastic adhesive which allows for necessary thermal movement of the panel system. No cold bond laminating with urethane or epoxy adhesives is acceptable.

J. The panel manufacturer shall have a minimum of five (5) years experience and shall have completed a minimum of five (5) projects of a similar size and scope.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Project Requirements.

B. Deliver components, aluminum wall panels, and other manufactured items so as not to be damaged or deformed. Package aluminum wall panels for protection during transportation and handling.

C. Unload, store, and erect aluminum wall panels in a manner to prevent bending, warping, twisting, and surface damage.

D. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store aluminum wall panels to ensure dryness, with positive slope for drainage of water. Do not store aluminum wall panels in contact with other materials that might cause staining, denting, or other surface damage.

E. Retain strippable protective covering on aluminum wall panels for period of wall panel installation.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of aluminum wall panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before aluminum wall panel fabrication, and indicate measurements on Shop Drawings. General Contractor shall guarantee critical working points and opening or elevation dimensions (if contractor wants to release panel fabrication prior to other work being in place) in order to accelerate delivery.

1.7 COORDINATION

A. Coordinate aluminum wall panel system with roof work, flashing, trim, and construction of framing and other adjoining work.
1.8 WARRANTY

A. Submit in accordance with Section 01 74 00.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures, including rupturing, cracking, or puncturing.
      b. Deterioration of metals and other materials beyond normal weathering.
   2. Warranty period for performance and workmanship shall be five (5) years.

C. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 INSULATED METAL PANELS

A. General: Provide factory-formed and -assembled aluminum wall panels fabricated from two metal facing sheets and insulation core using extruded silicone gaskets and extruded aluminum flanges on panels, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
   1. Polyisocyanurate Insulation-Core:
      a. Alply custom insulated panels manufactured by Alply, Litchfield, Illinois (217)-324-6700; apply classic wall (Basis of Design)
      b. Substitutions: Under provisions of Section 01 60 00.
      c. Prefinished and formed, smooth, insulated metal sandwich panels.
      d. Skins shall be .040 thickness, 2002H14 aluminum. Aluminum shall be smooth and flat. No stucco embossing is acceptable. Flatness criteria shall be .010 in a 6” rule. No “oil canning” is acceptable. Insulation shall be formed polyisocyanurate with density of 1.8 to 2.3 pounds per cubic foot with minimum tensile strength of 24 PSI. Thermoplastic or polyethylene core material will not be accepted. Panel thickness to be indicated on the drawings and as required for specified insulating value. Exterior finish face of panel shall be coil coated Fluoropolymer (PVDF) 70% Kynar 500, consisting of 1.5 mil. Fluropolymer (PVDF) three coat system: 0.2 mil primer with 0.8 mil Kynar 500 (70%) metallic color coat and 0.5 mil clear coat. Interior face of panel shall be mill finish .040 aluminum.
      e. Panel Thickness: 1.5 inches.
      f. Thermal Resistance Value (R-Value): 10.5
2.2 MISCELLANEOUS METAL FRAMING

A. Zee Clips: 0.079-inch nominal thickness.

B. Base or Sill Angles: 0.079-inch nominal thickness.

C. Hat sub girts with bituminous paint or tap separator, gauge and sizes as required by panel manufacture.

D. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.3 MISCELLANEOUS MATERIALS

A. Panel Fasteners: Unless otherwise noted, provide self-tapping screws; bolts and nuts; self-locking rivets and bolts; end-welded studs; and other suitable fasteners designed to withstand design loads. EXPOSED FASTENERS ARE NOT PERMITTED ON THIS APPLICATION.

2.4 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fascia, Mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.

B. Joinery gaskets shall be extruded, dry seal silicone. No wet seal sealants shall be acceptable with the gasket specified system with the exception of interface details with adjoining systems or as indicated on drawings.

C. Flashing and Trim: Formed from 18 gauge minimum thickness, aluminum sheet pre-painted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent aluminum wall panels. Do not lap seams of flashing and trim sections. Therefore, butt sections and provide concealed internal splice plates set in sealant.

2.5 FABRICATION

A. General: Fabricate and finish metal wall panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements. Field fabrication or field modification of any panels will not be permitted without written authorization by panel manufacturer that warranty and performance will not be affected.

B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
C. Fabricate metal wall panel joints with extruded silicone per system design.

D. Aluminum Panel Interface with Curtain Wall System is designed to be seamless with aluminum panel face flush with face cap on curtain wall. Panel to nest into glazing pocket of curtain wall system. Refer to contract drawings for location(s).

E. Corner Panels: All outside corner panels are to be furnished as one panel turning the corner without any joint or break in the panel.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. All exposed aluminum exterior surfaces shall be a 3-coat coil-coated Kynar Finish.
   1. Colors: As selected by Owner/Architect from manufacturer’s full range of colors during construction.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.
   1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
   2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
   3. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
   4. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

07 41 30-6 INSULATED ALUMINUM WALL PANEL SYSTEM WCPS: Boonsboro High School Auditorium & Stage Renovations
3.2 PREPARATION

A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

3.3 METAL WALL AND SOFFIT PANEL INSTALLATION, GENERAL

A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Contract Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the work securely in place, with provisions for thermal and structural movement.
   1. Shim or otherwise plumb substrates receiving metal wall panels.
   2. Flash and seal metal wall panels with weather closures at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.

B. Fasteners: As recommended by systems manufacturer.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.

3.4 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

3.5 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.

B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION
PART 1   GENERAL

1.1  SECTION INCLUDES

A. Omega-Lite aluminum-faced composite panels, air and vapor barrier, attachments and sealants.

1.2  RELATED SECTIONS

A. Section 08 11 13 – Hollow Metal Doors and Frames: Aluminum composite panels installed in hollow metal frame assemblies.

1.3  REFERENCES


1.4 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Design system to accommodate movement of components without buckling, failure of joint seals, undue stress on fasteners, or other detrimental effects when subjected to temperature and humidity ranges reasonably anticipated.
   2. Design system to accommodate tolerances of structure.

B. Performance Requirements:
   1. Submit test data witnessed by an independent testing agency for the following requirements:
      a. Structural tests for wind loads by "Chamber Method" in compliance with ASTM E72.
         1) Standard test design loading: 20 psf (960 Pa) positive and negative wind load.
         2) Design panel system to withstand code imposed design loads and a deflection limit of L/180 shall apply to positive load pressures only.
         3) Design panel system to withstand code imposed design loads and a deflection limit of L/175 shall apply to positive load pressures only.
      b. Air Infiltration: 0.06 cfm per square foot (32 lps per square meter) air leakage under a static pressure of 1.56 psf (7.65 kg/sq m) when tested in accordance with ASTM E283.
      c. Water Penetration: No uncontrolled water penetration through the standard vertical panel and sealed joints at a static pressure of 6.24 psf (30.5 kg/sq m) when tested in accordance with ASTM E331.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Submit shop drawings showing layout, flashings, drainage, ventilation, vapor barriers, vapor retarders, profiles and product components, including anchorage, accessories, finish colors, patterns and textures.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 3 inches (76 mm) by 5 inches (128 mm) representing actual product, color, and patterns.

F. Quality Assurance Submittals: Submit the following:
   1. Test reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria, and physical requirements.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction, approving acceptable installer and approving application method.

B. Installer Qualifications:
   1. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
   2. Panel Installer shall assume responsibility for all components of the exterior panel system including, but not limited to attachment to sub-construction, panel to panel joinery, panel to dissimilar material joinery, and joint seal associated with the panel system.

C. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store panels horizontally, off-the-ground, in manufacturer's unopened packaging until ready for installation.

B. Examine delivered materials upon receipt to insure that no damage has occurred during shipment. Store metal-faced composite wall panels horizontally, covered with a suitable weather tight and ventilated covering. Store Metal-faced composite wall panels to ensure dryness, with a positive slope for drainage of water. Do not store metal-faced composite wall panels in contact with other materials that might cause staining, denting, or other surface damage. DO NOT allow storage space to exceed 120 degrees F (49 degrees C).

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 WARRANTY

A. Finish Warranty: Commencing on Date of Substantial Completion.
   1. Provide 10 year written warranty with NQ20 finish color coated metal finish covering color fading, chalking, and film integrity.
   2. Provide 20 year written warranty with PVDF fluoropolymer finish color coated metal finish covering color fading, chalking, and film integrity.
   3. Finish coating shall not peel, blister, chip, crack or check.
4. Chalking, fading or erosion of finish measured by the following tests:
   a. Finish coating shall not chalk in excess of 8 numerical ratings when measured in accordance with ASTM D659.
   b. Finish coating shall not change color or fade in excess of 8 NBS units as determined by ASTM D2244.

B. Material and Installation Warranty: Commencing on Date of Substantial Completion.
   1. When installed as directed by Laminators, panels covered by this warranty are warranted not to delaminate (separate) at any Laminators produced glue line for a period of five (5) years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Laminators Incorporated; (215) 723-8107.

B. Substitutions: Under Provisions of Section 01 60 00.

2.2 OMEGA-LITE ALUMINUM-FACED COMPOSITE PANELS

A. Panel system shall be equal to Omega-Lite Composite Panels as manufactured by Laminators Incorporated.
   1. Panel Construction: Prefinished aluminum sheet over a corrugated polyallomer (CPA) core with pre-finished aluminum backer sheet.
   2. Panel Facing: Smooth face, 0.032 inch (0.8 mm) thick, ASTM B209 aluminum sheet.
   3. Panel Backing: Same as face sheet.
   4. Panel Thickness: 6 mm (1/4 inch).
   5. Fire Test Performance: ASTM E84: Class A.
   7. Finish: Kynar 500 - PVDF fluoropolymer paint system meeting AAMA 2605.
   8. Finish Colors: As selected by Architect from manufacturer’s stocked premium colors.

2.3 ACCESSORIES

A. Manufacturer’s Sealants and Accessories: Provide manufacturer’s recommended sealants and accessories for product installation.

2.4 FABRICATION

A. Panels shall be fabricated and finished as required to provide material construction and performance as specified and as required by manufacturer to comply with warranty provisions.
   1. Tolerances: Length and Width: plus or minus 1/16 inch (1.6mm). Squareness (Diagonals): equal within 1/8 inch (3.2mm).
PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Examine substrates, areas, and conditions, with substrate installer present, for compliance with requirements for structural soundness, installation tolerances, metal panel supports, and other conditions affecting performance of work.
   1. Examine primary and secondary wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances listed below.
      a. 1/4 inch (6 mm) in any 20 feet (6 m) length vertically or horizontally.
      b. 1/2 inch (12 mm) in any building elevation.
   2. Examine solid wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required.
   3. For the record, prepare written report, endorsed by panel installer and substrate installer, listing remedy for conditions detrimental to performance of work.

C. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before metal panel installation.

D. Proceed with installation only after all unsatisfactory conditions have been corrected.

E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

A. Confirm stability of hollow metal frame.

B. Comply with manufacturer's installation guides, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation type selected.

C. Work shall be done and completed in a thorough and workmanlike manner by mechanics skilled in their various trades.

D. Caulk Installation:
   1. Use only approved sealants as described in Laminators, Incorporated. Installation Guidelines.
   2. The sealant manufacturer's instructions shall be followed in preparing and installing sealants.
   3. Joints to receive sealant shall be clean, dry and free from dust, grit and contaminants.
   4. The sealant shall completely fill the glazing pockets.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.
3.4 CLEANING AND PROTECTION

A. Protection: Protect installed product and finish surfaces from damage during construction.

B. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

C. Protect installed products until completion of project.

D. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION
SECTION 07 52 20 – HYBRID COMPOSITE BUILT-UP ASPHALT ROOFING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Built-up asphalt roofing system.
   2. Roof insulation.

B. Related Sections include the following:
   1. Section 06 11 40 – Wood Blocking and Curbing for wood blocking, curbs, cant, and nailers; and wood-based, structural-use roof deck panels.
   2. Section 07 71 00 – Manufactured Roof Specialties for roof curbs, equipment supports, roof hatches, roof walkways, heat and smoke vents.
   3. Section 07 90 00 – Joint Sealers.

C. Unit Prices: Refer to Division 1 Section “Unit Prices” for description of Work in this Section that is affected by unit prices.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

B. Hot Roofing Asphalt: Roofing asphalt heated to its equiviscous temperature, the temperature at which its viscosity is 125 centipoise for mopping application and 75 centipoise for mechanical application, within a range of plus or minus 25 deg F (14 deg C), measured at the mop cart or mechanical spreader immediately before application.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Provide a roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to FMG 1-A-90

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

C. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.

B. Manufacturer Qualifications: A qualified manufacturer that has [UL listing] for roofing system identical to that used for this Project.

C. Source Limitations: Obtain components for roofing system from roofing system manufacturer.

D. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
   1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.
   2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

E. Pre-installation Conference: Conduct conference at Project site. Comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to roofing system including, but not limited to, the following:
   1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
   2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
   5. Review structural loading limitations of roof deck during and after roofing.
   6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
   7. Review governing regulations and requirements for insurance and certificates if applicable.
   8. Review temporary protection requirements for roofing system during and after installation.
   9. Review roof observation and repair procedures after roofing installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.
B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
   1. Special warranty includes roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners, cover boards, and other components of roofing system.
   2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Built-up Hybrid Asphalt Roofing:
      a. Firestone Building Products I-(3)FP-31-G (Basis of Design)
      b. Johns Manville Corp.
      c. GAF Materials Corp.

B. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 ROOFING MEMBRANE PLIES

A. Ply Sheets: ASTM D 2178, Type VI, asphalt-impregnated, glass-fiber felt.

B. Cap Sheet: ASTM D 6164, asphalt-impregnated and coated, glass-fiber cap sheet, with white coarse mineral-granule top surfacing and fine mineral surfacing on bottom surface.
2.3 FLASHING MATERIALS

A. Flashing Base Sheet: ASTM D 6163, Type I, glass fiber reinforced SBS-modified asphalt-impregnated sheet, dusted with fine mineral surfacing on both sides.

B. Flashing Cap Sheet: ASTM D 6164, Type I or II, polyester-reinforced, SBS-modified asphalt sheet; granular surfaced; suitable for application method specified and as follows:

2.4 ASPHALT MATERIALS

A. Asphalt Primer: ASTM D 41.

B. Roofing Asphalt: ASTM D 312, Type III or IV as recommended by built-up roofing system manufacturer for application.

2.5 AUXILIARY ROOFING MEMBRANE MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with built-up roofing.

B. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application.

C. Mastic Sealant: Polyisobutylene, plain or modified bitumen, non-hardening, non-migrating, non-skimming, and nondrying.

D. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FM 4470; designed for fastening roofing membrane components to substrate; tested by manufacturer for required pullout strength; and acceptable to roofing system manufacturer.

E. Metal Flashing Sheet: Metal flashing sheet is specified in Division 7 Section "Sheet Metal Flashing and Trim."

F. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.

2.6 ROOF INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

B. Refer to Section 07 22 00 – Roof and Deck Insulation for detailed requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
   1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof
deck at penetrations and terminations and that nailers match thicknesses of
insulation.
3. Verify that surface plane flatness and fastening of steel roof deck comply with
requirements in Division 5 Section "Steel Deck."
4. Verify that concrete curing compounds that will impair adhesion of roofing
components to roof deck have been removed.
5. Verify that concrete substrate is visibly dry and free of moisture. Test for
capillary moisture by plastic sheet method according to ASTM D 4263.
a. Test for moisture by pouring 1 pint (0.5 L) of hot roofing asphalt on deck at
start of each day's work and at start of each roof area or plane. Do not
proceed with roofing work if test sample foams or can be easily and cleanly
stripped after cooling.
6. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing
installation according to roofing system manufacturer's written instructions. Remove
sharp projections.
B. Prevent materials from entering and clogging roof drains and conductors and from
spilling or migrating onto surfaces of other construction. Remove roof-drain plugs
when no work is taking place or when rain is forecast.
C. Prime surface of concrete deck with asphalt primer at a rate of 3/4 gal./100 sq. ft. (0.3
L/sq. m) and allow primer to dry.

3.3 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to
precipitation or left exposed at the end of the workday.
B. Comply with roofing system manufacturer's written instructions for installing roof
insulation.
C. Refer to Section 07 22 00 – Roof and Deck Insulation for detailed insulation.

3.4 ROOFING MEMBRANE INSTALLATION, GENERAL

A. Install built-up roofing membrane system according to roofing system manufacturer's
written instructions and applicable recommendations of ARMA/NRCA's "Quality
Control Guidelines for the Application of Built-up Roofing."
1. Install roofing system I-3G-31-M, according to roofing system manufacturers
specifications and "The NRCA Roofing and Waterproofing Manual"
requirements for designed system.
B. Start installation of built-up roofing membrane in presence of roofing system
manufacturer's technical personnel.
C. Cooperate with testing and inspecting agencies engaged or required to perform services
for installing built-up roofing system.
D. Coordinate installing roofing system components so insulation and roofing membrane
sheets are not exposed to precipitation or left exposed at the end of the workday or
when rain is forecast.
1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.
2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
3. Remove and discard temporary seals before beginning work on adjoining roofing.

E. Asphalt Heating: Heat roofing asphalt and apply within plus or minus 25 deg F (14 deg C) of equiviscous temperature unless otherwise required by roofing system manufacturer. Do not raise roofing asphalt temperature above equiviscous temperature range more than one hour before time of application. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating. Do not heat roofing asphalt within 25 deg F (14 deg C) of flash point. Discard roofing asphalt maintained at a temperature exceeding finished blowing temperature for more than 4 hours.

F. Substrate-Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.5 ROOFING MEMBRANE INSTALLATION

A. Install one lapped course of base sheet, extending sheet over and terminating beyond cants. Attach base sheet as follows:
   1. Adhere to substrate in a solid mopping of hot roofing asphalt.

B. Install three ply sheets starting at low point of roofing system. Align ply sheets without stretching. Shingle side laps of ply sheets uniformly to achieve required number of plies throughout thickness of roofing membrane. Shingle in direction to shed water. Extend ply sheets over and terminate beyond cants.
   1. Embed each ply sheet in a solid mopping of hot roofing asphalt applied at rate required by roofing system manufacturer, to form a uniform membrane without ply sheets touching.

C. Cap Sheet: Install lapped granulated cap sheet starting at low point of roofing system. Offset laps from laps of preceding ply sheets and align cap sheet without stretching. Lap in direction to shed water. Extend cap sheet over and terminate beyond cants.
   1. Embed cap sheet in a solid mopping of hot roofing asphalt applied at rate required by roofing system manufacturer.

3.6 FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:
   1. Prime substrates with asphalt primer if required by roofing system manufacturer.
   2. Flashing Base Sheet Application: Mechanically fasten backer sheet to walls or parapets. Adhere base sheet over roofing membrane at cants in a solid mopping of hot roofing asphalt.
   3. Flashing Cap Sheet Application: Adhere flashing sheet to substrate in a solid mopping of hot roofing asphalt applied at not less than 425 deg F (218 deg C). Apply hot roofing asphalt to back of flashing sheet if recommended by roofing system manufacturer.

B. Extend base flashing up walls or parapets a minimum of 8 inches (200 mm) above roofing membrane and 4 inches (100 mm) onto field of roofing membrane.
C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
   1. Seal top termination of base flashing.

D. Install stripping, according to roofing system manufacturer's written instructions, where metal flanges and edgings are set on built-up roofing.
   1. Flashing-Sheet Stripping: Install flashing-sheet stripping in a continuous coating of asphalt roofing cement or in a solid mopping of hot roofing asphalt applied at not less than 425 deg F (218 deg C), and extend onto roofing membrane.
   3. Built-up Stripping: Install stripping of not less than 2 roofing membrane ply sheets, setting each ply in a continuous coating of asphalt roofing cement or in a solid mopping of hot roofing asphalt, and extend onto roofing membrane 4 inches (100 mm) and 6 inches (150 mm), respectively.

E. Roof Drains: Set 30-by-30-inch metal flashing in bed of asphalt roofing cement on completed roofing membrane. Cover metal flashing with stripping and extend a minimum of 4 inches (100 mm) beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
   1. Install flashing-sheet stripping by same method as installing base flashing.
   2. Install stripping of not less than two roofing membrane ply sheets, each set in a continuous coating of asphalt roofing cement or in a solid mopping of hot roofing asphalt.

3.7 COATING INSTALLATION

A. Apply coatings to base flashings according to manufacturer's written instructions, by spray, roller, or other suitable application method.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

B. Test Cuts: Before flood coating and surfacing built-up roofing membrane, test specimens will be removed to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:
   1. Approximate quantities of components within roofing membrane will be determined according to ASTM D 3617.
   2. Test specimens will be examined for interply voids according to ASTM D 3617 and to comply with criteria established in Appendix 3 of ARMA/NRCA's "Quality Control Guidelines for the Application of Built-up Roofing."

C. Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation and submit report to Architect.
   1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

D. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
3.9 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. This section includes the materials and application procedures for a Thermoplastic Polyolefin (TPO) Single Ply Roofing System as Alternate with hot applied vapor barrier.
   1. Refer to Section 01 15 00 – Alternates; Alternates 8A through 8E; TPO single ply roofing system in lieu of Section 07 52 20 – Hybrid Composite Built-Up Asphalt Roofing System.

B. Other Manufacturers’ System may be considered as a substitution as noted if such substitution meets or exceeds performance standards as specified per this section and as approved by Owner.

1.02 RELATED DOCUMENTS

A. Drawings and contract documents, including Section 01 01 00 Summary of Work, apply to this section.

1.03 RELATED SECTIONS INCLUDE THE FOLLOWING:

A. Section 05 31 10 - Steel Roof Deck
B. Section 06 11 40 - Wood Blocking and Curbing
C. Section 07 22 20 - Roof and Deck Insulation
D. Section 07 71 00 - Manufactured Roof Specialties

1.04 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 6878 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.05 PERFORMANCE REQUIREMENTS

A. General: Install a watertight, fully adhered single ply thermoplastic roofing system with compatible components that will not permit the passage of liquid water and will withstand wind loads, thermally induced movement, and exposure to weather.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Provide a roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to FMG 1-A-90.

1.06 REFERENCES

A. ASTM - American Society for Testing and Materials, West Conshohocken, PA.
B. NRCA - National Roofing Contractors Association, Chicago, IL
C. UL - Underwriter’s Laboratory, Northbrook, IL.

1.07 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
C. Warranties: Special warranties specified in this Section.

1.08 QUALITY ASSURANCE
A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.
B. Manufacturer Qualifications: A qualified manufacturer that has UL listing for roofing system identical to that used for this Project.
C. Roofing system manufacturer shall provide onsite inspection at intervals noted per Section 01 10 00. A formal report shall be submitted within seven (7) days to Owner/Architect.
D. Source Limitations: Obtain components for roofing system from roofing system manufacturer.
E. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.
2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.
F. Pre-installation Conference: Conduct conference at Project site. Comply with requirements in Section 01 31 00. Review methods and procedures related to roofing system including, but not limited to, the following:
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing installer, roofing system manufacturer's representative, deck installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.09 DELIVERY, STORAGE, AND HANDLING
A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.
B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.10 PROJECT CONDITIONS
A. Weather Limitations: Proceed with roofing work only when existing and forecasted weather conditions permit roofing to be installed. Single Ply Systems shall not be installed during periods of precipitation.
B. Applications that involve known, severe exposures require a complete review by the manufacturer before their acceptance. This includes, but is not limited to, unusual building exposure to wind, unusual roof slope, unusual roof use, unusual exposure to contaminants, openings in the structure (greater than 10% of the wall surface), which could be left open in a storm, roofs subject to positive pressure conditions and roofs greater than 45 feet in height. For roofs subject to special job conditions, contact an authorized manufacturer’s agent.

1.11 WARRANTY
A. Section 01 74 00 – Warranties and Bonds: Requirements for warranties.
B. Special Warranty: Written warranty in which Manufacturer agrees to repair roof installations that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Membrane failures including rupturing, cracking, or puncturing.
      b. Deterioration of membranes, coatings, metals, metal finishes, and other associated materials beyond normal weathering.
      c. Limit of Warranty Coverage: Not to exceed original purchase price of manufacturer's materials, except that manufacturer may elect to apply the limit amount toward the following:
d. Purchase of replacement application within the first 5 years following completion of roofing work.

2. Qualified Installer Requirement: Installer must meet requirements of Quality Assurance Article.

3. Installation Inspection Requirement: By Roofing Inspector in accordance with requirements of Article 3.11 below.

4. Annual Manufacturer Inspection and Preventive Maintenance Requirement: By manufacturer's technical representative, to report maintenance responsibilities to Owner necessary for preservation of Owner's warranty rights. The cost of manufacturer's annual inspections and preventive maintenance is included in the Contract Sum. Inspections to occur in Years 2, 5, 10, 15, and 20 following completion.

5. Warranty Period: 25 years from date of completion of roofing work.

C. Installer's Warranty: Submit roofing Installer's warranty signed by Installer, covering the Work of this Section and related Sections indicated above, including all components of built-up roofing such as built-up roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Tremco Incorporated
   2. Firestone
   3. Verisco
   4. Carlisle
   5. Other manufacturers systems that may be considered if the system meeting or exceeds the specified requirements as approved by Owner.

2.02 THERMOPLASTIC ROOF MEMBRANE MATERIALS

A. TPO Field Membrane Sheets:
   1. TPO Elastomeric Sheeting
      a. Flexible thermoplastic polyolefin roofing membrane with polyester weft-inserted reinforcement.
      b. Exceeds the performance requirement of ASTM D 6878.
      c. Surface Color: White or Gray (exposure) (gray underside).
      d. Thickness: 60 mil
   2. Approved equal by Owner.

B. TPO Field Membrane Adhesive: Cold applied adhesive, elastomeric, asbestos free, Low-VOC TPO bonding adhesive.

C. Vapor Barrier: Self-adhering vapor barrier, Class 1 vapor retarder, non-slip UV resistant; SBS modified bitumen adhesive, factory laminated to tri-laminate woven, high density polyethylene top surface; equal to Firestone’s V-Force Vapor Barrier Membrane.

D. Slip Sheet: Red Rosin paper.
E. Base Sheet: Non-perforated, waterproof asphalt coated, polyester/glass scrim/ glass mat tri-laminate reinforcement coated sheet, meeting ASTM D 4601, Type II sheet. Asbestos free. Equal to Firestone’s MB Base Sheet or as required by system manufacturer.

F. Base Sheet Primer: As required by system manufacturer. Low-VOC, low odor, spray applied.

G. Provide manufacturer’s recommendation flashings and other roof accessories.

2.03 BASE FLASHING MATERIALS

A. Base Flashing Sheets:
   1. TPO Perimeter Sheet.
      a. Flexible thermoplastic polyolefin roofing membrane with polyester weft-inserted reinforcement.
      b. Exceeds the performance requirement of ASTM D 6878.
      c. Surface Color: Match roof membrane
      d. Thickness: 60 mil
   2. Approved equal per Owner.

B. Base Flashing Primer:
   1. Asphalt primer water-based, polymer modified.
   2. Low VOC compliant asphalt primer: Solvent-based asphalt primer.

C. Base Flashing Adhesive:

D. Membrane Coated Metal Flashing:
   1. TPO Coated Metal:
      a. 0.060 mil thick membrane laminated to 0.023" (minimum) G90, 24 gauge, hot dipped galvanized steel with back wash coat of 0.0001" clear acrylic.
      b. White Sheet Metal Stock
         1) Size: 4’ by 10’ per sheet
   2. Approved equal by Owner.

E. Flashing Accessories:
   1. Cover Strip:
      a. TPO Cover Strip
         1) Reinforced TPO Flashing Membrane
         2) Roll Size: 6” by 108” by 40 mil thick.
   2. 2-Piece Drain Flashing Membrane:
      a. TPO Flashing Membrane
         1) Unreinforced TPO membrane
         2) Roll Size: 24” by 30” by 55 mil thick.
   3. Vent Pipe Boots:
      a. TPO Prefabricated Flashing Boots
         1) Unreinforced TPO membrane
         2) Pipe Size as required:
            a) Small 1 inch to 4 inches
            b) Large 4 inches to 8 inches
      b. TPO Field Fabricated Boots
         1) TPO Flashing Membrane
         2) Unreinforced TPO membrane
         3) Roll Size: 24” by 30” by 55 mil thick.
4. Corners:
   a. TPO Prefabricated Universal Corners
      1) Unreinforced TPO membrane
      2) Size: 3-1/2 inches (nominal) to all edges

5. Drain Sealant:
   a. Waterblock sealant as recommended by system manufacturer.
   b. Urethane sealant as recommended by system manufacturer.
   c. Or approved equal by Owner.

2.04 MEMBRANE FASTENERS AND PLATES
A. All screw type fasteners shall be a minimum #15 shank diameter for membrane securement. Hex head fasteners are not permitted for insulation or membrane securement.
B. Factory coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FM 4470; designed for fastening roofing membrane components to substrate, tested by manufacturer for required pull-out strength, and acceptable to roofing system manufacturer.

2.05 ACCESSORY MATERIALS
A. Metal cleaner: Mineral spirits
B. TPO Membrane cleaner: Acetone by others.
C. Termination bar:
   1. Aluminum, with caulk receiver: 1/4 by 1 inch
   2. Primer: TremPrime Non-Porous Primer or equal.
   3. Caulking: One part urethane caulk.
D. Temporary Tie-in Materials.
   2. Foam Pack by others.
E. Pitch Pan Fill:
   2. Top fill: Two-part polyurethane, two compartment (1:1 ratios), solvent free, low odor urethane sealant, two-color for reliable mixing.
F. Air Seal:
   1. Backer Rod by others: Joint backing rod, closed cell polyethylene, non-bleeding neoprene, or butyl.
   2. Foam Pack by others.
G. Scuppers:
   1. Pre-fabricate assembly with TPO membrane covered metal.

2.06 WALK PADS
A. TPO Walkway Roll:
   1. A gray thermoplastic membrane which is comprised of a thermoplastic olefin. TPO Walkway Roll is reinforced with a high strength, wick resistant polyester fabric and has a serrated, slip resistant surface. TPO Walkway Roll is asbestos free and exceeds the performance requirements of ASTM D 6878.
2. Roll Size: 3’ by 60’ by 80 mil thick.
3. Color: Gray

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions under which roofing will be applied, with installer present, for compliance with requirements.

B. Verify that roof openings and penetrations are set in place and braced.

C. Verify that roof drains are properly clamped into position.

D. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at roof penetrations and terminations and match the thickness of insulation required.

3.02 PREPARATION

A. Clean substrate of dust, debris, and other substances detrimental to roofing installation according to roofing system manufacturer’s written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.03 JOB CONDITIONS

A. Prior to the use of any TPO roofing material, consult Material Safety Data Sheets for applicable cautions and warnings.
1. Do not use oil or bituminous base roof cement with TPO materials.
2. Do not install TPO membrane directly in contact with new or resaturated asphalt.
3. Do not expose membrane or accessories to temperatures of 180°F or above.
4. Do not allow waste products (petroleum grease, oil or solvents, etc.) or direct steam venting to come in contact with the TPO roofing system. Any exposures not typical for normal roofing installation must be presented to the Roof Manufacturer for assessment of any impact on the performance of the roofing system.
5. Do not install TPO membrane directly in contact with coal tar roof surfaces.
6. Install polyethylene vapor barrier ply under new insulation layer when mechanically attached TPO membrane system is installed over existing coal tar roofs.
7. Ponding conditions will adversely affect performance of the roofing system. Where positive drainage does not exist, water removal from roof surface should be facilitated by lowering drains, and/or installing additional drains, tapered insulation, or an approved lightweight insulating concrete slope system.

3.04 GENERAL INSTALLATION REQUIREMENTS

A. Install thermoplastic roofing membrane system according to roofing system manufacturer’s written instructions and applicable recommendations of
ARMA/NRCA’s “Quality Control Guidelines for the Application of Thermoplastic Roofing”.

B. Install roofing system per manufacturer’s published specifications manual.

C. Coordinate installation of roofing system components so insulation and roofing plies are not exposed to precipitation or remain exposed at the end of the workday or when rain is forecast.

D. At cementitious wood fiber deck, provide slip sheet and water proof base sheet nailed, then install self-adhering vapor barrier membrane.

E. Provide water cutoffs at end of each day’s work to cover exposed ply sheets and insulation. Water tightness of the water cutoffs is the Contractor’s responsibility.

F. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.

G. Remove and discard temporary seals before beginning work on adjoining roofing.

H. Substrate-Joint Penetrations: Prevent adhesive from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.05 INSULATION INSTALLATION

A. Coordinate installing roofing system components, so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system manufacturer’s written instructions for installing roofing insulation.

C. Refer to Section 07 22 00 Roof and Deck Insulation for detailed requirements.

3.06 HOT AIR WELDING EQUIPMENT

A. Manufacturer’s TPO seams can only be made by the hot-air welding process. When the membrane is properly fused, the hot-air heat welding process produces seams that are as strong as the TPO membrane itself. The following information is presented as a guide to assist Contractors in utilizing hot-air heat welding equipment. Prior to actual selection and operation of the hot-air heat welding equipment, refer to the manufacturer’s operating instructions. The operation of hot-air heat welding equipment, and the results obtained utilizing this equipment, are the responsibility of the roofing Contractor.

1. Leister Variant Automatic Welder
   b. Power cord and plugs: #10 wire with 3-prong twist plug. #10 wire may be used up to 150' in length. For longer lengths, consult an electrician for line voltage drop.
   c. Element: 4500 Watts
   d. Adjustment Tools: Adjustable wrench, various metric box wrench, various metric allen wrenches, screwdrivers, 40mm nozzle only.
   e. Additional Weight: A 45lb. Supplemental weight is required for the automatic welder. It shall rest on the aluminum housing over the rear wheels when the welder is being used.

2. Leister “Triac” Hand Welder
a. Power requirements: 115 volts, 15 amps, and 1800 watts single phase.
b. Power cord #12. Check with electrician for line voltage drop for length over 200'.
c. Element: 1600 Watt
d. Accessories: 40mm nozzle, various silicone and metal rollers.

3. Power Generators
   a. If a power generator is used only for the automatic welder, a minimum of 220 volts, 30 amps and 7500-watts unit is required. If additional items are used such as hand welder, screw guns or other equipment, increased generator capacity is required. A minimum 220 volt, 30 amp and 1000 watts generator is recommended.

3.07 ADHERED TPO ROOF MEMBRANE INSTALLATION

A. Install membrane according to roofing system manufacturer’s written instructions, starting at low point of roofing system. Place ply sheets to ensure water will flow over or parallel to, but never against exposed edges. Shingle in direction to shed water.
   1. Install sheet according to ASTM D 5036.
   2. Install air seal where required at perimeter, curbs and penetration flashings.
   3. Manufacturer’s TPO membrane shall be fully adhered to properly installed and prepared substrate surface. The surface shall be clean, dry, smooth, and free from contamination.
   4. The roof perimeters and corners may require additional design to develop the necessary resistance for wind conditions in excess of gale force winds. Contact manufacturer for additional information if the building is located where winds may exceed standard warranty conditions or special code provisions are required.
   5. The membrane shall be cut to fit neatly around all penetrations and roof projections.
   6. The roofing membrane shall be unrolled and positioned with a minimum 3-inch overlap. Laps shall be shingled with, or run parallel to, the slope of the roof.

B. TPO Field Membrane Application using TPO Single Ply Bonding Adhesive:
   1. Install (60 mil) Reinforced TPO field membrane sheets.
   2. Install TPO field sheets using TPO Single Ply Bonding Adhesive. Stir the TPO Single Ply Bonding Adhesive thoroughly. Do not thin adhesive with solvents. Apply bonding adhesive to both substrate and membrane surfaces at a rate of 50 to 60 square feet per gallon per side.
   3. Begin field membrane installation at low point of deck. Allow sheet to overhang roof edge a minimum of 1-1/2 inches below lower edge of wood nailer.
   4. Position roll of TPO sheeting in a manner, which provides sufficient material to facilitate flashing. The roofing membrane shall be unrolled and positioned square with the roof edge. Laps shall be shingled with, or run parallel to, the slope of the roof. Overlap side laps 3 inches and end laps minimum three (3) inches. Install succeeding rolls in same manner. Avoid wrinkles. Reposition sheet when necessary. Do not stretch material unevenly.
   5. Fold sheet back so one-half (1/2) of the underside of the sheet is exposed. Ensure the sheet fold is smooth with no wrinkles or buckles.
   6. Over the properly installed and prepared surface, TPO Single Ply Bonding Adhesive shall be applied using approved solvent-resistant roller or power roller equipment. The adhesive shall be applied in a smooth even coating.
with no globs, puddles, voids or similar irregularities. Only areas that can
be completely covered in the same day shall be coated with adhesive. The
surface with adhesive coating shall be allowed to become tacky prior to
installing the roof membrane. Do not allow adhesive to fully dry prior to
placing membranes. If the surface dries to the point that it no longer feels
tacky re-apply bonding adhesive to substrate at the specified application
rate and allow to flash off again to the proper drying condition.

a. Drying time of the adhesive increases with the presence of higher
humidity or cooler temperatures.

7. Bonding adhesive shall not be applied to lap (seam) areas that are to be
welded to flashings or adjacent membrane sheets by means of hot air
welding procedures. If contamination occurs, remove any contaminates
prior to hot air welding seams.

8. When the surface is ready, roll the TPO membrane onto the adhesive
covered substrate avoiding wrinkles.

9. Using a push broom or membrane roller and positive downward pressure,
brush down the bonded half of the membrane sheet to achieve maximum
contact.

10. Fold back the unbonded half of the sheet and repeat bonding procedure.

11. Apply adjoining sheets in same manner, lapping edges a minimum of 3”.

12. Any wrinkles found in the splice area or that impedes the flow of water
drainage, must be cut out, laid flat and repaired using TPO membrane and
standard hot air seam welding procedures.

13. Remove and replace all sheets that are not fully bonded.

14. Mechanically attach membrane sheets at roof perimeter and penetrations.
Fasteners shall have 2 3/8 inch diameter barbed metal plates. Fasteners
shall be placed a minimum of 12 inches on center and 1-1/8 inch from
sheet edge in a true and straight.

15. Minimize foot traffic on freshly applied TPO membrane until adhesive is
fully cured.

16. Membrane Seaming:
   a. All edge surfaces to be seamed by hot air welding. Surfaces must
      be wiped with solvent using clean rags.
   b. Heat-weld laps with approved welding equipment. Adjust welding
      speed and temperature base upon ambient conditions and material.

17. Membrane End Laps:
   a. Continuous End Lap Detail
      1) Overlap the previous membrane course of field membrane
         a minimum of 2”. Heat weld membrane lap.
   b. Staggered End Lap Detail
      1) Offset staggered end laps a minimum of 5’.
      2) Overlap the previous course of field membrane a minimum
         of 2”. Heat weld membrane lap.
   c. Abutted End Lap Detail
      1) Gap width between membrane sheets shall not exceed 1/8
         inch.
      2) Install 6-inch wide cover strip over end lap. Cut cover strip
         corners round. Heat-weld cover strip centered over end lap.

18. Heat-weld a 4” round field cut TPO flashing membrane (unreinforced)
centered over each T-joint on 60-mil thick or greater membrane.

C. Perimeter/Projection Attachment:
   1. Mechanically attach roofing membrane at roof perimeters, curbs, and
pipe/stack penetrations greater than 12” in diameter, on both sides of
expansion joints and other areas where the membrane must be anchored to
prevent movement, stress or damage to the roofing membrane.
2. Provide mechanical attachment at deck angle changes in excess of 2”/12” (including drain sump areas).
3. Follow the recommendations of Factory Mutual Loss Prevention Data Sheets 1-28, and 1-29 (dated May 2004 or latest edition).

D. Roof Drain Detail:
1. Prepare substrate around each roof drain to prevent membrane bridging or distortion and to provide a smooth transition from the roof surface to the drain clamping ring.
2. Remove existing flashing and bituminous materials from drain components down to bare clean metal.
3. Install tapered edge strip around drain to create approximate 48 by 48 inch sump. Miter corners.
4. Install minimum 1/2 inch bead of drain sealant over entire drain bowl rim (approximately 1/2 tube per drain).
5. Install 2-piece drain flashing detail.
   a. Terminate field membrane along outside edge of sump. Install target patch consisting of unreinforced TPO flashing membrane over drain sump and past drain bowl rim. Extend flashing a minimum of 3” outside of the sump area and heat weld to field sheet.
6. Clamp flashing collar to drain. Fully compress drain sealant between the new membrane and the drain bowl rim forming a solid seal between the two. Evenly compress the assembly to avoid cracking or breaking the clamping ring. Replace cracked or broken drain clamping rings.
   a. All bolts and/or clamps must be in place in order to provide constant, even compression. Missing drain bolts and clamps shall be replaced.
7. Neatly cut membrane within drain at rim. Membrane to extend 1 inch into bowl.
8. For working drains, remove drain plug upon completion of work each day.
9. Plug new drains to prevent water entry until service connection is completed.

E. Membrane Seaming:
1. Clean seam areas, overlap roofing membrane and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.
2. All surfaces shall be clean and dry. Ensure both mating surfaces are free of debris and no moisture is present on the splicing surfaces.
   a. Using a clean rag saturated with appropriate cleaner, thoroughly clean seam area at least 4 inches wide on both sheets. Change rags frequently to avoid depositing previously removed materials.
3. Using an approved automatic heat welding machine or hand held heat gun and steel roller, continuously weld a minimum 1 1/2” wide seam. Minimum width of welded lap shall be 1-1/2 inch when using an automatic welder. Hand welds shall be a minimum of 2-inches wide. Only approved Automatic Walker Welders shall be used to weld seams (see Hot Air Welder Equipment).
4. Special attention must be paid to areas where multiple layers of TPO membrane (3 or more) come together (T-joints).
   a. If probing these areas reveals the presence of voids or cold welds on 45 mil membrane, install a 4” round field cut TPO flashing membrane (unreinforced) to the formed T-joint.
   b. A 4” round field cut TPO flashing membrane (unreinforced) is required at each T-joint on 60 mil or greater membrane.
5. Allow hot air welder to warm up. Insert the nozzle tip of the hot air welder into seam area. Move nozzle at a steady speed along the seam area, immediately applying pressure behind the air nozzle with a neoprene roller or weighted wheel to ensure positive contact of the heated TPO roof membrane lap.

6. Test lap edges with probe to verify seam weld continuity.
   a. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
   b. All welded seams must be manually checked for voids or seal deficiencies by probing the entire seam area with a dull cotter key extractor after the seam has cooled. Properly constructed laps will not separate at the lap interface when tested. In addition, there must be destructive testing performed at the beginning of every workday and every time there is an interruption in the welding process (i.e. Power failure, welder shut down and job site conditions change). All deficiencies must be repaired.
   c. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.

F. TPO Membrane End Lap Details:
1. Continuous End Lap Detail
   a. Abut end laps. Gap width between membrane sheets shall not exceed 1/8 inch.
   b. Install 6-inch wide cover strip membrane centered over end lap. Cut cover strip corners round. Heat-weld cover strip over end lap.

2. Staggered End Lap Detail
   a. Offset staggered end laps a minimum of 5’.
   b. Abut end laps. Gap width between membrane sheets shall not exceed 1/8 inch.
   c. Install 6-inch wide cover strip membrane centered over end lap. Cut cover strip corners round. Heat-weld cover strip over end lap.

3. Heat weld TPO cover strip.
   a. All surfaces must be clean and dry.
   b. For heat welding, allow the hot air welder to warm up. Insert the nozzle tip of the hot air welder into the seam area. Move nozzle at a steady speed along the seam area, immediately applying pressure behind the air nozzle with a neoprene roller or weighted wheel to ensure positive contact of the heated TPO Roof Membrane lap.
   c. Minimum width of all welded lap shall be 1.5”

4. Field test heat welded to assure proper construction. Perform field test after lap area cools to ambient temperatures. Properly constructed laps will not separate at the lap interface when tested.

3.08 GENERAL FLASHING REQUIREMENTS AND STRIPPING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer’s written instructions.

B. Clean existing asphalt from vertical surfaces where flashings will be applied. Prime as recommended by system manufacturer. Contractor’s option to provide plywood sheathing to cover. Do not cover existing thru wall flashing.

C. Clean seam areas, overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

D. All flashings shall be installed as shown on the detail drawings. All TPO membrane flashings shall be installed concurrently with the roof membrane as the project
progresses. No temporary flashings shall be allowed without prior written approval of the authorized manufacturer’s agent. If any water is allowed to enter under the new roofing due to incomplete flashings, the affected area shall be removed and replaced at Contractor’s expense.

E. Flashings shall not be applied over existing thru-wall flashings or weep holes. All flashings shall extend a minimum of 8-inches above roof level unless previously accepted by Owner and an authorized manufacturer’s agent. All existing flashings shall be removed before applying a new flashing. Install flashings in a neat and uniform manner with a “_rounding” of all exposed corners. Care should be taken to ensure that the flashing does not bridge where there is a change of direction.

F. Flash all pipes with TPO Pre-fabricated Flashing Boots where possible. Field fabricate pipe flashings with TPO Flashing Membrane (unreinforced flashing) per standard Manufacturer’s Roofing Systems details when a pre-molded flashing is not feasible.

G. Fabricate all metal flanged flashings using TPO Membrane Coated Metal. Hot air weld a 6-inch wide TPO cover strip to flashing membrane and coated metal flange.

H. Mix adhesive vigorously by hand to achieve a homogeneous blend. DO NOT use electrical equipment or open flame near adhesive. Do not thin adhesive with solvents.

I. Base Flashings Adhered in manufacturer’s TPO Single Ply Bonding Adhesive:
   1. Install all new TPO flashing details per manufacturer’s specifications, recommendations and standard detail drawings.
      a. Base flashing system shall consist of fully adhered (60 mil) TPO Perimeter Sheet membrane or (60 mil) Reinforced TPO Field membrane and adhered in Single Ply Bonding Adhesive.
      b. All flashings shall be installed as shown on the detail drawings and per manufacturer’s standards. All membrane flashings shall be installed concurrently with the roof membrane as the project progresses.
      c. Flashings shall not be applied over existing thru-wall flashings or weep holes. All flashings shall extend a minimum of 8-inches above roof level unless previously accepted by Owner and an authorized Tremco agent. All existing flashings shall be removed before applying a new flashing.
      d. Apply TPO Single Ply Bonding Adhesive in full coverage to both the substrate and to the back side of the TPO flashing membrane.
      e. The TPO base flashing membrane shall be fully adhered to a dry, smooth solvent-resistant and compatible substrate using approved bonding adhesive.
      f. When the TPO membrane has been cut to correct width and length, embed the flashing into the substrate adhesive, taking care to avoid wrinkles.
      g. Over properly prepared surface, TPO Single Ply Bonding adhesive shall be applied using approved solvent-resistant roller or power roller equipment.
         1) The adhesive shall be applied at a rate of 1-gallon per every 50 to 60 square feet per side. The adhesive shall be applied in a smooth even coating with no globs, puddles, voids or similar irregularities. Coverage will vary based on substrate porosity.
         2) Allow adhesive to dry to a tacky feel when touched with the back side of a dry finger before bonding membrane to
substrate. Drying time of the adhesive increases with the presence of higher humidity or cooler temperatures.

3) Do not allow adhesive to fully dry prior to placing membranes. If the surface dries to the point that it no longer feels tacky, re-apply bonding adhesive and allow to flash off to the proper drying condition.

h. Position TPO Flashing membrane in intended location and fold back. Apply TPO Single Ply Bonding Adhesive in full coverage to both the vertical substrate and to the back side of the flashing membrane. Allow adhesive to dry to a tacky feel when touched with the back side of a dry finger before bonding membrane to substrate. Place the flashing membrane onto the vertical substrate and pressure roll to assure positive contact. Do not allow TPO Single Ply Bonding Adhesive to contaminate TPO membrane and flashing lap areas. Remove adhesive from lap areas. Heat-weld overlap seams of TPO flashing and field membrane. Bonding adhesive shall not be applied to lap (seam) areas that are to be welded to flashings or adjacent membrane sheets by means of hot air welding procedures. If contamination occurs, remove any contaminates prior to hot air welding seams.

i. Care should be taken to ensure that the flashing does not bridge where there is a change of direction.

j. Apply consistent pressure to entire surface of elastomeric sheeting using a steel hand roller to achieve full adhesion of the sheet to the flashing substrate. Ensure complete bond and continuity without wrinkles or voids.

k. Clean seam areas and weld side and end laps to ensure a watertight seam installation.

l. The top of the installed flashing shall be fastened under metal counter flashing, coping cap, or through wall metal reglet. The maximum distance between fasteners for TPO flashings shall be 8 inches through flat bar or 12 inches through metal reglet. Install Flash (TF) Tape between masonry walls and top edge of TPO flashing membrane prior to fastening.

m. Install TPO prefabricated universal corners for sealing all inside and outside corners.

n. Fabricate all metal flashings with flanges using TPO Membrane Coated Metal. Secure flange to wood blocking as specified. Heat-weld a 6-inch wide (reinforced) TPO cover strip to flashing membrane and coated metal flange.

J. TPO Coated Metal Edge Flashing:

1. Fabricate and install manufacturer’s TPO coated metal flashing to comply with details and project drawings and the recommendations of SMACNA Sheet Metal Manuals for fabrication and Factory Mutual Loss Prevention Data Sheet I-49.

2. All metal work shall be completed in conjunction with the roofing and flashing operation to provide a daily watertight condition.

3. Metal shall be installed to provide adequate resistance to bending and to allow for normal thermal expansion and contraction. Allow for minimum 1/4 inches space between metal joints.

4. Metal flashing shall have a minimum 3 inches wide nailing flange and hemmed metal edge. Flange shall be no wider than underlying blocking. Metal flashing shall be fastened to solid wood blocking with annular ring nails, 4 inches o.c. Fasteners shall penetrate the wood a minimum of 1-1/4 inches.
5. Continuous metal hook strips are required on all metal fascias that exceed 4 inches. Each hook strip shall be fastened 12 inches o.c. into wood blocking or masonry wall. Hook strips should be continuous and at least 22-gauge. They should be secured with annular threaded nails long enough to penetrate the wood 1 - 1/4 inches. The nail head should be 3/16 inches minimum. When screws are used, they should be No. 8 minimum long enough to penetrate wood 3/4 inches or metal 3/8 inches. Screws should be 24 inches apart in Zone 1 and 16 inches apart in Zone 2 (refer to FM I-49). Screws should be either corrosion-resistant steel or treated to resist corrosion. When an existing metal panel wall has no hook strip, the fascia metal should be fastened directly to the wall with No. 8 galvanized sheet metal screws, through neoprene washers, spaced 24 inches in Zone 1 and 16 inches in Zone 2.

6. All gravel stops and drip edges with a face larger than 4 inches shall be installed using a continuous 22 gauge hook strip fastened 12 inches o.c. using galvanized annular ring nails.

7. Fasten TPO coated metal flashings 4 inches o.c. to treated wood nailers using galvanized annular ring nails.

8. Install TPO membrane coated metal flashings over field membrane. Flange of flashing component shall be at the same level as the insulation or other substrate to which the membrane will be applied.

9. Install adjacent pieces of coated metal flashing with 1/4 inches gap. Apply a 2 inches wide continuous strip of foil tape over the gap to act as a bond breaker. Hot air weld a 6 inches strip of TPO membrane, over the foil tape, to each piece of flashing to form a watertight splice.

10. Hot air weld a 6-inch wide TPO cover strip to field membrane and coated metal edge flashing.

K. Prefabricated Pipe Boots:
1. Remove existing pipe flashing.
2. Install plates and fasteners that secure field sheet as close to the penetration as possible.
3. Each boot is stepped in increments that will fit standard pipes. The top of the boot should be cut around the “step” which allows a stretch fit between the top of the boot over the stack.
4. Place the boot over the vent pipe.
5. Pull the flange down to the roof, stretching the collar portion around the vent pipe.
6. Inside the top of the boot shall be caulked to prevent water entry and a stainless steel hose clamp must be installed to secure the top edge of the boot to the vent pipe.
7. The flange of the boot is pre-scored and shall be cut at the circular score and then heat-welded (minimum 2”) onto the TPO field membrane.
8. Do not split the boot. If the boot cannot be installed intact, use field fabricated flashing per manufacturer’s details.
9. Manufacturer’s vent pipe boots can only be installed by hot-air heat welding.

L. Prefabricated Universal Corners
1. The manufacturer’s TPO prefabricated corners must be used for sealing the corners of all pitch pans, curbs, and walls. They are uniform in shape and size and provide water tightness at corners formed by TPO coated metal and flashing membrane.
2. The corners shall be cut at the scored lines to form either an inside or outside corner.
3. Use per heat welding techniques to fully weld the corner to the flashing following published manufacturer’s specifications and details.
4. Universal Corners can only be installed by hot-air heat welding.

M. TPO Pitch Pans with Grout:
2. Pack gap between roof-penetrating element and deck with compressible insulation.
3. Nail flange to wood blocking 3 inches o.c., staggered.
4. Strip-in flange with a 6-inch wide TPO cover strip heat welded to field membrane and coated metal edge flashing.
5. Install TPO prefabricated corners.
6. Fill pitch pan to within 1 inch from top with non-shrink grout. Allow to set firm.
7. Fill pitch pan with pourable sealer. Double fill if necessary.
8. Fabricate and install storm collar with drawband over pitch pan. Tighten drawband.

N. TPO Metal sleeve with Storm Collar:
2. Apply a heavy 3/8 inch bead of sealant to roofing surface receiving metal flange.
3. Nail flange to wood blocking 3 inches o.c., staggered.
4. Strip-in flanges with a 6-inch wide TPO cover strip heat welded to field membrane, and coated metal edge flashing
5. Install TPO prefabricated corners.

3.09 WALKWAY PAD APPLICATION

A. Install walkway pads at roof access points.

B. Heat weld walkway pad to field membrane.
1. Clean, smooth membrane ply surface with soap and water. Allow drying. All surfaces must be clean and dry prior to walkway application.
2. For heat welding, allow the hot air welder to warm up. Insert the nozzle tip of the hot air welder to the attachment area. Move nozzle at a steady speed, immediately applying pressure behind the air nozzle with a neoprene roller or weighted wheel to ensure positive contact of the TPO Walkway Roll to the roof membrane.
   a. Minimum width of welded lap shall be 2.0” and 6.0” long when performing hand welds.
   b. Spot weld Walkway Roll to roof membrane. Attachment of walkway roll should not impede drainage.
3. Field test heat welded laps to assure proper construction.
4. Perform field test after lap area cools to ambient temperatures. Properly constructed heat welds will not separate at the lap interface when tested.
3.10 DAILY WATERSTOP/TIE-INS

A. Install Tie-in.
   1. Remove embedded gravel/debris from top ply of felt along termination if built-up roofing system is present. Width: 24 inches.
   2. Remove dirt and debris from tie-in area. Width: 24 inches.
   3. Adhere 12 and 18-inch wide ply sheets from exposed deck to existing roofing with a continuous 1/16 thick application of tie-off mastic. Glaze cut-off with surfacing mastic. Extend 18 inch wide felt 3 inches either side 12-inch felt.
   4. Install “deadman” insulation filler at insulation staggers.
   5. Extend new roofing membrane at least 24 inches onto prepared area of adjacent existing roofing. Seal edge with 6 inches wide reinforcing membrane embedded between alternate courses of tie-off mastic.
   6. Remove temporary connection at beginning of next workday by cutting membrane evenly along edge of existing roof system. Remove “deadman” insulation fillers.

B. Alternate Tie-in:
   1. Remove embedded gravel/debris from top ply of felt along termination. Width: 24 inches.
   2. Remove dirt and debris from tie-in area. Width: 24 inches.
   3. Adhere 12 and 18-inch wide ply sheets from exposed deck to existing roofing with a continuous 1/16 thick application of tie-off mastic. Glaze cut-off with surfacing mastic. Extend 18-inch wide felt 3 inches either side 12-inch felt.
   4. Install “deadman” insulation filler at insulation staggers.
   5. Extend new roofing membrane at least 24 inches onto prepared area of adjacent existing roof.
   6. Attach TPO membrane ply lap over underlying membrane with adhesive and/or membrane fasteners and seam plates.
   7. Apply spray foam over leading edge of tie-in ply lap and exposed membrane fasteners and seam plates.
   8. Remove temporary connection at beginning of next workday by cutting membrane evenly along edge of existing roof system. Remove “deadman” insulation fillers.

3.11 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer’s technical personnel to inspect roofing installation on completion. Provide with copies of the previous inspection reports.

3.12 PROTECTING AND CLEANING

A. Protect roofing membrane from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to project superintendent.

B. Prior to performing work on a completed roof area that may cause damage the new roof, the roofing membrane and flashing shall be protected from physical damage. Proper and adequate protection includes installing a slip-sheet in the work area overlaid with plywood or OSB Board in order to dissipate the effects of traffic on the finished roof surface and to prevent impact damage to the system caused by dropped tools and or equipment. If damage does occur to the roof system it must be immediately repaired in order to preserve the integrity of the roof insulation.
C. Correct deficiencies in or remove roofing that does not comply with requirements, repair substrates, reinstall roofing, and repair base flashings to a condition free of damage and deterioration at the time of Substantial Completion and according to warranty requirements.

D. Clean over spray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

E. Contractor shall be responsible for vehicles and other property that is contaminated by cold adhesive over spray or drippage.

END OF SECTION
PART 1  GENERAL

1.1  WORK INCLUDED

A. Copings, Fascias, Fascia, Extruded Closure and Vents.
B. Reglets.
C. Downspout Boots.

1.2  RELATED WORK

A. Section 07 41 30 – Insulated Aluminum Wall Panel System.

1.3  REFERENCES

A. ASTM D2822 - Asphalt Roof Cement

1.4  SUBMITTALS

A. Submit under provisions of Section 01 33 00.
B. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.
C. Product Data: Provide product data on shape of components, materials and finishes, anchor types and locations.
D. Samples: Submit two (2) samples, 12 x 12 inches in size illustrating component shape, finish and color.
E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.5  QUALITY ASSURANCE

A. Perform Work in accordance with NRCA details or as detailed within the documents.
B. All components shall be from one manufacturing source.

1.6  WARRANTY

A. Copings, fascia, fascia extenders, closures and reglets shall be covered by the roofing warranty specified in Section 07 52 20.
PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specified Manufacturer:
   1. Hickman
   2. Neenah Foundry
   3. S-5

B. Other Acceptable Manufacturers:
   1. Merchant and Evans

C. Substitutions: Under provisions of Section 01 60 00.

2.2 COMPONENTS

A. Fascias, Copings, Roof Edge, Fascia Extenders, Extruded Closures:
   1. Equal to Hickman’s 5.25 inch TerminEdge system for membrane roofing systems
      .063 inch thick, shaped as indicated, with 0.50 inch retainer. Include cover plates
      to conceal and weather seal joints and attachment flanges.
   2. Equal to Hickman’s 8 inch Shadowline Coping System for membrane roofing
      systems. 0.063 inch thick, shaped as indicated with 12 inch wide, 20 gauge
      galvanized steel anchor cleats at minimum 5’-0” on center mechanically fastened.
      Include internal concealed splice plates and gutter support chairs with matching
      finish.
   3. Provide extruded closure plates and end caps as required and mitered, welded
      corners. Color shall be Kynar 500, 25 year finish as selected by the Architect.

B. Reglets: shall be equal to Hickman’s Systems, Drive-Lock reglet and counterflashing
   fabricated from stainless steel. Provide factory fabricated corners and wind clips.
   Counterflashing shall be 4 ¾” long. Color shall be Kynar 25 year finish as selected by
   the Architect.
   1. The specified reglet (Hickman Drive-Lock DLR 625) shall be fabricated in 26 gage
      stainless steel with shop-fabricated corners. The warranty shall be five (5) years
      against defects, but a 20-year warranty against blow off or leaks with wind
      conditions up to 110 mph @ 3 second max. peak gusts.

C. Downspout Boots: Equal to Neenah Foundry cast iron downspout boot model R-4929-
   A6C Offset Downspout with cleanout with 4” x 6” receiver (field verify) by 30 inches
   long with sized receiver to receive downspout. Provide powder coating to color
   matching downspouts.

2.3 ACCESSORIES

A. Sealant: Roofing Manufacturer's standard type suitable for use with installation of
   system; non-staining, skinning, non-skinning, non-shrinking and non-sagging;
   ultra-violet and ozone resistant; color as selected.

2.4 FINISHES

A. Provide color as selected by the Architect from the full range of Kynar formulations
   with 20 year manufacturer's limited warranty.
PART 3  EXECUTION

3.1  INSPECTION

A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.

3.2  INSTALLATION

A. Install components in accordance with manufacturer's instructions.

B. Conform to NRCA - Waterproofing Manual drawing details.

C. Coordinate installation of components of the section with installation of roofing membrane and base flashings.

D. Coordinate installation of flashing flanges into reglets.

END OF SECTION
PART 1   GENERAL

1.1 SUMMARY

A  Section includes firestopping and through-penetration protection system materials and accessories; firestopping tops of fire rated walls; and smoke sealing at joints between floor slabs and exterior walls.

B  Related Sections:
   1.  Section 09 26 00 - Gypsum Board Assemblies: Gypsum board fireproofing.
   2.  Division 23 - Mechanical: Mechanical work requiring firestopping.
   3.  Division 26 - Electrical: Electrical work requiring firestopping.

1.2 REFERENCES

D  FM (Factory Mutual Engineering Corporation) - Fire Hazard Classifications.
E  UL (Underwriters Laboratories, Inc.) - Fire Resistance Directory.
G  UL 723 (Underwriters Laboratories, Inc.) - Test for Surface Burning Characteristics of Building Materials.
H  UL 1479 (Underwriters Laboratories, Inc.) - Fire Tests of Through-Penetration Fire stops.
I  WH (Warnock Hersey) - Directory of Listed Products.

1.3 DEFINITIONS

A  Firestopping (Through-Penetration Protection System): A sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest the movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A  Firestopping Materials: UL 263 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1-hour fire rating.
B  Surface Burning: UL723 with a maximum flame spread / smoke developed rating of 25/450.
C  Fire stop interruptions to fire rated assemblies, materials, and components.
1.5 PERFORMANCE REQUIREMENTS

A Conform to applicable code UL or WH for fire resistance ratings and surface burning characteristics.

B Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

A Section 01 33 00 - Submittal Procedures: Submittal procedures.

B Product Data: Submit data on product characteristics, performance and limitation criteria.

C Schedule: Provide a schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

D Manufacturer's Installation Instructions: Submit preparation and installation instructions.

E Manufacturer's Certificate: Certify products meet or exceed specified requirements.

F Engineering Judgements: For conditions not covered by UL or WH listed designs, provide judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALIFICATIONS

A Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B Applicator: Company specializing in performing Work of this section with minimum three years documented experience, and approved by manufacturer.

1.8 MOCK-UP

A Section 01 40 00 - Quality Requirements: Mock-up requirements.

B Apply 1 linear ft. of each type of linear firestopping material to a representative substrate surface.

C Apply one of each unit type of firestopping material, such as penetrations through a fire rated partition, to a representative application.

D Mock-ups may remain as part of the Work.

1.9 ENVIRONMENTAL REQUIREMENTS

A Section 01 60 00 - Product Requirements.

B Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F.

C Maintain this minimum temperature before, during, and for minimum 3 days after
installation of materials.

1.11 PROJECT CLOSEOUT

A. In accordance with Section 01 73 00, the manufacturer and installer shall provide a letter of certification that all installations have been completed in accordance with the approved details and assemblies.

PART 2 PRODUCTS

2.1 FIRESTOPPING

A Manufacturers:
1. STI
2. United States Gypsum Co. Fire Stop System
3. Substitutions: Section 01 60 00 - Product Requirement.

B Product Description: Different types of products by a single manufacturer are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application. Multiple manufacturers are not permitted.
1. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.

C Color: Red

2.2 ACCESSORIES

A Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B Dam Material: Permanent: Mineral fiber matting.

C Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

PART 3 EXECUTION

3.1 EXAMINATION

A Section 01 31 00 - Administrative Requirements: Coordination and project conditions.

B Verify openings are ready to receive firestopping.

3.2 PREPARATION

A Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material.

B Remove incompatible materials which may affect bond.

3.3 APPLICATION
A  Install material at fire rated construction perimeters and openings which contain penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping in accordance with approved UL listed assemblies.

B  Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C  Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

D  Compress fibered material to maximum 40 percent of its uncompressed size.

3.4 FIELD QUALITY CONTROL

A  Section 01 40 00 - Quality Requirements: Testing and Inspection Services.

B  Inspect installed firestopping for compliance with specifications and submitted schedule.

3.5 CLEANING

A  Section 01 73 00 - Execution Requirements: Final cleaning.

B  Clean adjacent surfaces of firestopping materials.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A  Section 01 50 00 – Construction Facilities and Temporary Controls: Protecting installed construction.

B  Protect adjacent surfaces from damage by material installation.

END OF SECTION
PART 1  GENERAL

1.1  SECTION INCLUDES

A. Preparing substrate surfaces.
B. Sealant and joint backing.

1.2  RELATED SECTIONS

A. Section 02 52 00 - Portland Cement Concrete Paving: Sealants required in conjunction with paving.
B. Section 03 30 00 - Cast-in-Place Concrete: Sealants required in conjunction with cast-in-place concrete.
C. Section 04 81 00 - Unit Masonry Assemblies: Sealants required in conjunction with masonry.
D. Section 08 11 20 - Standard Steel Frames: Sealants required in conjunction with door frames.
E. Section 08 41 00 - Aluminum Framed Storefronts.
F. Section 08 44 00 - Aluminum Curtain Walls.
G. Section 09 66 23 – Resinous Matrix Terrazzo Flooring: Sealants required in conjunction with floor and base finish.

1.3  REFERENCES

A. ASTM C790 - Use of Latex Sealing Compounds.
B. ASTM C804 - Use of Solvent-Release Type Sealants.
C. ASTM C834 - Latex Sealing Compounds.
D. ASTM C919 - Use of Sealants in Acoustical Applications.
E. ASTM C920 - Elastomeric Joint Sealants.
F. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
H. SWRI (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification.

1.4  SUBMITTALS

A. Submit under provisions of Section 01 33 00.
B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.
C. Samples: Submit two samples, 1 x 4 inch in size illustrating sealant colors for selection.
D. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, and perimeter conditions requiring special attention.

1.5 QUALITY ASSURANCE
A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

1.5 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
B. Applicator: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by manufacturer.

1.6 ENVIRONMENTAL REQUIREMENTS
A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.7 COORDINATION
A. Coordinate work with other trades.
B. Coordinate the work with all sections referencing this section.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS
A. Pecora
B. Tremco
C. Bostik
D. Sika
E. Substitutions shall be submitted in accordance with Section 01 60 00.

2.2 SEALANTS
A. Polyurethane Traffic Grade Sealant (Type A): ASTM C920, Two Part, chemical curing, non-staining, non-bleeding, capable of continuous water immersion, self-leveling type; color as selected; Urexpan NR-200 manufactured by Pecora.
   1. Elongation Capability  25 percent
   2. Service Temperature Range  -40 to 180 degrees F
   3. Shore A Hardness Range  20 to 35

B. Polyurethane Sealant (Type B): ASTM C920, Grade NS, Class A, chemical curing, non-staining, non-bleeding, capable of continuous water immersion, non-sagging type; color as selected; Dynatrol II manufactured by Pecora.
   1. Elongation Capability  50 percent
2. Service Temperature Range -20 to 180 degrees F
3. Shore A Hardness Range 20 to 35

C. Silicone Sealant (Type C): ASTM C920, Grade NS, Class 25, Use NT; single component, fungus resistant, chemical curing, non-sagging, non-staining, non-bleeding; color as selected; 860 manufactured by Pecora.
1. Elongation Capability 25 percent
2. Service Temperature Range -75 to +400 degrees F
3. Shore A Hardness Range 15 to 50

2.3 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: ASTM D1565; round, open cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces and joint openings are ready to receive work.
B. Verify that joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

A. Remove loose materials and foreign matter which might impair adhesion of sealant.
B. Clean and prime joints in accordance with manufacturer's instructions.
C. Perform preparation in accordance with manufacturer's instructions.
D. Protect elements surrounding the work of this section from damage or disfigurement.

3.3 INSTALLATION

A. Install sealant in accordance with manufacturer's instructions.
B. Measure joint dimensions and size materials to achieve required 2:1 width/depth ratios.
C. Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.
D. Install bond breaker where joint backing is not used.
E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
G. Tool joints concave.

3.4 CLEANING
   A. Clean work under provisions of 01 73 00.
   B. Clean adjacent soiled surfaces.

3.5 PROTECTION OF FINISHED WORK
   A. Protect finished installation under provisions of Section 01 50 00.
   B. Protect sealants until cured.

3.6 SCHEDULE
   **General:** The following sealants shall be installed throughout the construction where
   construction materials intersect or abut creating a joint which requires closure for appearance,
   weather, or as may be required by the Owner and Architect.

<table>
<thead>
<tr>
<th>Location</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Exterior horizontal concrete paving &amp; sidewalk expansion joints</td>
<td>Two part polyurethane Traffic Grade Type II</td>
</tr>
<tr>
<td>(Type A)</td>
<td></td>
</tr>
<tr>
<td>B. Exterior vertical joints (Type B)</td>
<td>Two part polyurethane Type II</td>
</tr>
<tr>
<td>C. Interior vertical &amp; horizontal joints (Type B)</td>
<td>Two part polyurethane Type II</td>
</tr>
<tr>
<td>D. Interior wet areas, kitchen, &amp; toilet fixtures joints w/fungicide</td>
<td>High modulus silicone</td>
</tr>
<tr>
<td>(Type C)</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Standard and custom hollow metal doors and frames.
   2. Steel sidelight, borrowed lite and transom frames.
   3. Light frames and glazing installed in hollow metal doors.

B. Related Sections:
   1. Section 04 81 00 - Unit Masonry for embedding anchors for hollow metal work into masonry construction.
   2. Section 08 21 00 - Wood Doors
   3. Section 08 80 00 - Glazing for glass view panels in hollow metal doors.
   4. Section 08 71 00 - Door Hardware.
   5. Section 09 90 00 - Painting for field painting hollow metal doors and frames.
   6. Section 28 13 00 - Access Control for access control devices installed at door openings and provided as part of a security access control system.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
   2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
   3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
   4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
   5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
   6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Include the following:
   1. Elevations of each door design.
   2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of anchorages, joints, field splices, and connections.
   6. Details of accessories.
   7. Details of moldings, removable stops, and glazing.
   8. Details of conduit and preparations for power, signal, and control systems.

D. Samples for Verification:
   1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A25.0.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Perform work in accordance with Door Hardware Institute (DHI). The installation of commercial steel doors and steel frames, insulated steel doors in wood frames and builder’s hardware.

D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40” above sill) or UL 10C.
   1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
   2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
   a. Smoke "S" Label: Doors to bear “S” label and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

E. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.

F. Energy Efficient Exterior Openings: Comply with minimum thermal ratings, based on ASTM C1363. Openings to be fabricated and tested as fully operable, thermal insulating door and frame assemblies.
   1. Thermal Performance (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM C1363 and meet or exceed the following requirements:
      a. Door Assembly Operable U-Factor and R-Value Ratings: U-Factor 0.29, R-Value 3.4, including insulated door, thermal-break frame and threshold.
   2. Air Infiltration (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM E283 to meet or exceed the following requirements:
      a. Rate of leakage of the door assembly shall not exceed 0.25 cfm per square foot of static differential air pressure of 1.567 psf (equivalent to 25 mph wind velocity).

G. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
   1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
1.8 **WARRANTY**

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
   1. CECO Door Products (CE).
   2. Curries Company (CU).
   4. Amweld Building Products Inc.
   5. Pioneer Industries.
   6. Republic Builders Products.
   7. Substitutions: Permitted in accordance with Section 01 60 00.

**2.2 MATERIALS**

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

**2.3 HOLLOW METAL DOORS**

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

B. Exterior Doors (Energy Efficient): Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, and ANSI/SDI A250.4 for physical performance level.
   1. Design: Flush panel.
   2. Core Construction: Foamed in place polyurethane and steel reinforced core with no stiffener face welds.
      a. Provide 18 gauge steel vertical reinforcements 6 inches apart and welded in place. Foamed in place polyurethane core is chemically bonded to all interior surfaces. No face welding is permitted.
      b. Thermal properties to rate at a fully operable minimum U-Factor 0.374 and R-Value 2.53, including insulated door, Mercury thermal-break frame and threshold.
c. Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.378 and R-Value 2.5, including insulated door, kerf type frame, and threshold.

3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2, seamless.

4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 0.040” thick inverted, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.

5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".

6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A1008/A1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Polystyrene foam and steel channel grid, securely bonded to both faces.
   a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch) thick steel, Model 2, seamless.
4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 0.040” thick inverted, extending the full width of the door and welded to the face sheet.
5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Manufacturers Basis of Design:
1. Curries Company (CU) - Polystyrene Core - 707 Series.
2. Curries Company (CU) - Energy Efficient - 797 Mercury Series.

2.4 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames. Tested for thermal performance in accordance with NFRC 102, and resistance to air infiltration in accordance with NFRC 400. Where indicated provide thermally broken frame profiles available or use in both masonry and drywall construction. Fabricate with 1/16” positive thermal break and integral vinyl weatherstripping.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
3. Manufacturers Basis of Design:
   a. Curries Company (CU) - Thermal Break TQ Series.

D. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
   1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
   2. Level 3 for door models 2, nominal 16 gauge / 0.053 inch thick material, base metal thickness.
   3. Manufacturers Basis of Design:
      a. Curries Company (CU) - M Series.

E. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

F. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

G. Sound Rated Door: STC of 40, measured in accordance with ASTM E413.

2.5 FRAME ANCHORS

A. Jamb Anchors:
   1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick; or wire anchors not less than 0.177 inch thick.
   2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator’s shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

2.7 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.
C. Door Louvers: Roll formed material; inverted Y-blades, sight proof, primed painted.

D. Silencers; Resilient vinyl fitted into drilled holes. Minimum three (3) per frame.

E. Bituminous Coating: Fibered asphalt emulsion.

F. Primer: ANSI A250.10 rust inhibitive type.

G. Weatherstripping: Specified in Section 08 71 00.

2.8 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:
   1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
   2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
   3. Astragals: Provide overlapping astragals as noted in door hardware sets in Section 08 71 00 - Door Hardware on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
   4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Section 08 71 00 - Door Hardware.
   5. Electrical Raceways: Provide hollow metal doors to receive electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through-wire transfer hardware or wiring harness specified in hardware sets in Section 08 71 00 - Door Hardware and Section 28 13 00 – Access Controls. Wire nut connections are not acceptable.

D. Hollow Metal Frames:
   1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.  
      a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreaders are for bracing only and are not to be used to size the frame opening.
   3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.

5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Section 08 71 00 - Door Hardware.

6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.

7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.

8. Floor Anchors: Weld anchors to bottom of jambs and milllions with at least four spot welds per anchor.

9. Jamb Anchors: Provide number and spacing of anchors as follows:
   a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      1) Two anchors per jamb up to 60 inches high.
      2) Three anchors per jamb from 60 to 90 inches high.
      3) Four anchors per jamb from 90 to 120 inches high.
      4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
   b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      1) Three anchors per jamb up to 60 inches high.
      2) Four anchors per jamb from 60 to 90 inches high.
      3) Five anchors per jamb from 90 to 96 inches high.
      4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
      5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.

10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Section 08 71 00 - Door Hardware.

11. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 08 71 00 - Door Hardware.

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.

2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.

3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.
2.9 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
   1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
   2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
   3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
   1. Non-Fire-Rated Standard Steel Doors:
      a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
      b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
      c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
   2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Field Glazing: Comply with installation requirements in Section 08 80 00 - Glazing and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY
A. Section includes wood doors fire rated and non-rated.

1.2 SUBMITTALS
A. Shop Drawings: Indicate door elevations, cutouts for glazing and hardware preparation.
B. Samples: Submit three (3) samples of door veneer, 4 x 4 inch in size illustrating wood grain, veneer pattern, veneer joints, color, and finish.

1.3 QUALITY ASSURANCE
A. Perform work in accordance with NWWDA I.S.1.
B. Fire Rated Door and Panel Construction: Conform to one of the following:
   1. NFPA 252; with neutral pressure level at 40 inches maximum above sill at 5 minutes into test.
   2. UL 10C.
   3. 20-Minute Fire Rated Corridor Doors: Fire tested without hose stream test.
C. Fire Rated Stair Doors: Rate of rise of 450 degrees F across door thickness.
D. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated on Drawings.
E. Attach label from agency approved by authority having jurisdiction to identify each fire rated door.

1.4 WARRANTY
A. Furnish lifetime manufacturer warranty to include delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.
B. Furnish manufacturer’s Life of Installation warranty for interior doors.

PART 2 PRODUCTS

2.1 WOOD DOORS
A. Manufacturers:
   1. Algoma Hardwoods Inc.
   2. Eggers Industries.
   3. Weyerhauser.
   5. Graham.
6. Substitutions: Permitted in accordance with Section 01 60 00.

B. Product Description: Solid core wood doors, fire rated, non-rated; flush and design; wood veneer site finished.
   1. Flush Interior Doors: 1-3/4 inches thick; solid core seven ply construction; fire acoustical as indicated on Drawings.

2.2 COMPONENTS

A. Core:
   1. Core (Solid, Non-Rated): NWWDA, Type Structural composite lumber core.

B. Flush Door Facing:
   1. Wood Veneer: NWWDA Grade 1 - Premium; Maple species wood, plain sliced with book match grain, for transparent finish.
      a. Pair match multiple door leaves in single opening.
   2. Adhesive: NWWDA, Type 1 - waterproof.

2.3 ACCESSORIES

A. Glass Stops: Wood of same species as door facing type conform to UL requirements.

2.4 FABRICATION

A. Fabricate doors in accordance with NWWDA I.S.1 requirements.

B. Astragals for Double Doors: Steel, T shaped, recessed at face edge.

C. Fabricate doors with hardware reinforcement blocking in place.

D. Factory machine doors for finish hardware.

E. Factory fit doors for frame opening dimensions identified on shop drawings.

2.5 FINISH

A. Custom factory finish doors in accordance with approved sample.

B. Seal door top edge with color sealer to match door facing.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install doors in accordance with NWWDA I.S.1 requirements.

B. Coordinate installation of glass and glazing.

C. Install door louvers plumb and level.

D. Coordinate installation of doors with installation of steel frames specified in Section 08 11 00 and hardware specified in Section 08 71 00. Glass specified in Section 08 80 00.
E. Adjust door for smooth and balanced door movement.

F. Tolerances:
   1. Maximum Diagonal Distortion: 1/4 inch measured with straight edge, corner to corner.

3.2 SCHEDULE
   A. Refer to Drawings.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section includes fire resistive rated and non-rated access doors and panels with frames.
   1. Provide for access to controls, valves, traps, dampers, cleanouts, and similar items requiring operation behind inaccessible finished surfaces.
   2. Coordinate exact locations with various trades to assure proper placement of access doors and panels.

B. Related Sections:
   1. Section 09 90 00 - Paints and Coatings: Field paint finish.

1.2 REFERENCES

A. ASTM International:

B. Intertek Testing Services (Warnock Hersey Listed):
   1. WH - Certification Listings.

C. National Fire Protection Association:

D. Underwriters Laboratories Inc.:
   1. UL - Building Materials Directory.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate exact position of access door units.

C. Product Data: Submit literature indicating sizes, types, finishes, hardware, scheduled locations, fire resistance listings, and details of adjoining Work.

D. Samples: Submit two 12 x 12 inch in size illustrating frame configuration and anchors.

E. Manufacturer's Installation Instructions: Submit installation requirements and rough-in dimensions.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 73 00 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of access units.
1.5 QUALITY ASSURANCE

A. Fire Resistance Ratings: Where indicated as fire rated provide assemblies from manufacturers listed in UL Directory or Intertek Testing Services (Warnock Hersey Listed) Directory.

B. Fire Rated Horizontal Access Doors: Rating as indicated on Drawings.
   1. Tested Rating: Determined in accordance with ASTM E119.

C. Attach label from agency approved by authority having jurisdiction to identify each fire rated access door.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified with minimum three years documented experience, and with service facilities within 100 miles of Project.

1.7 COORDINATION

A. Section 01 31 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work with work requiring controls, valves, traps, dampers, cleanouts, and similar items requiring operation being located behind finished surfaces.

PART 2 PRODUCTS

2.1 ACCESS DOORS AND PANELS

A. Manufacturers:
   1. J. L. Industries.
   3. Nystrom Products Co.
   5. Substitutions: Section 01 60 00 - Product Requirements.

B. Flush Framed Access Doors (Type 1): Frames and nominal 1 inch wide exposed flanges of 16 gage steel and door panels of 14 gage steel.

C. Gypsum Board Access Doors (Type 2): Frames and nominal 1 inch wide flanges of 16 gage steel and door panels of 14 gage steel. Design flanges to be concealed by gypsum board joint finishing compound specified in Section 09 26 00.

D. Recessed Wall Access Doors (Type 4): Frames and nominal 1 inch wide flanges of 14 gage steel and door panels of 16 gage steel. Door recessed ½” with factory installed ½” gypsum board. Flanges to be concealed by gypsum board joint finishing compound specified in Section 09 26 00.

E. Fire Rated Access Doors (Type 5): Frames and nominal 1 inch wide exposed flanges of minimum 16 gage steel and door panels of 20 gage steel. Provide self closing and latching doors with keyed lock to match cylinders specified in Section 08 71 00.

2.2 FABRICATION

A. Fabricate units of continuous welded construction; weld, fill, and grind joints to assure flush and square unit.
B. Wall and Ceiling Access Door and Panel Hardware:
   1. Hinge: Standard continuous or concealed spring pin type, 175 degree steel hinges.
   2. Lock: Self-latching lock. Screw driver slot for quarter turn cam lock.

C. Floor Hatch Hardware:
   1. Hinge: 175 degree steel continuous hinge with removable pin concealed constant force closure spring type.
   2. Lock: Self-latching lock. Screw driver slot for quarter turn cam lock. Cylinder lock with latch, two keys for each unit.

D. Size Variations: Obtain acceptance of manufacturer’s standard size units which vary slightly from sizes shown or scheduled.

2.3 SHOP FINISHING

A. Base Metal Protection: Prime coat units with baked on primer.

B. Finish: One coat baked enamel, color as selected.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 - Administrative Requirements: Coordination and project conditions.

B. Verify rough openings for access doors and panels are correctly sized and located.

3.2 INSTALLATION

A. Secure frames rigidly in place, plumb and level in opening, with plane of door and panel face aligned with adjacent finished surfaces.
   1. Set concealed frame type units flush with adjacent finished surfaces.

B. Position unit to provide convenient access to concealed work requiring access.

C. Install fire rated units in accordance with NFPA 80 and requirements for fire listing.

3.3 SCHEDULES

A. Gypsum Board Ceilings: Type 2, 24 x 24 inch size, screwdriver slot lock, primed and one coat baked enamel "White".

B. Gypsum Board Walls: Type 4, 36x 24 inch size, cylinder lock. Paint to match adjacent finish.

C. Washroom Walls Above Urinal Valves: Type 1, 12 x 12 inch size, cylinder lock, primed and two coat baked enamel to match ceramic tile color.

D. Fire Rated Masonry Walls: Type 5, 12 x 12 inch size, cylinder lock, primed.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section includes aluminum-framed storefronts including aluminum and glass doors.

B. Related Sections:
   1. Section 07 90 00 - Joint Sealers: System perimeter sealant and back-up materials.
   2. Section 08 71 00 - Finish Hardware: Mortised hardware reinforcement requirements affecting framing members; hardware items other than specified in this section.
   3. Section 08 80 00 - Glazing.
   4. Single Source Requirement: All products listed below shall be from same manufacturer.
      a. 08 44 00 – Aluminum Curtain Walls.

1.2 REFERENCES

A. Aluminum Association:

B. American Architectural Manufacturers Association:
   1. AAMA 501 - Methods of Test for Exterior Walls.
   9. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site.

C. American Society of Civil Engineers:
D. ASTM International:
3. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
11. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors by Uniform or Cyclic Static Air Pressure Difference.

E. National Fenestration Rating Council Incorporated:
1. NFRC 100 - Procedures for Determining Fenestration Product U-Factors.

F. National Fire Protection Association:

G. SSPC: The Society for Protective Coatings:
1. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).
2. SSPC Paint 25 - Red Iron Oxide, Zinc Oxide, Raw Linseed Oil, and Alkyd Primer.

H. Underwriters Laboratories Inc.:

1.3 SYSTEM DESCRIPTION

A. Aluminum-framed storefront system includes tubular aluminum sections with supplementary internal support framing, aluminum and glass entrances, shop fabricated, factory finished, glass and glazing, related flashings, anchorage and attachment devices.

B. System Assembly: Site assembled.
1.4 PERFORMANCE REQUIREMENTS

A. System Design: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall, including building corners.
   1. To design pressure of 25 lb/sq ft, as tested in accordance with ASTM E330.

B. Deflection: Limit mullion deflection to flexure limit of glass of span; with full recovery of glazing materials.

C. System Assembly: Accommodate without damage to components or deterioration of seals, movement within system, movement between system and peripheral construction, dynamic loading and release of loads, deflection of structural support framing.

D. Air Infiltration: Limit air leakage through assembly to 0.06 cfm/min/sq ft of wall area, measured at reference differential pressure across assembly of 1.57 psf as measured in accordance with ASTM E283.

E. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glass and inner sheet of infill panel and heel bead of glazing compound.

F. Water Leakage: None, when measured in accordance with ASTM E331 with test pressure difference of 20 percent of design pressure, with minimum differential of 2.86 lbf/sq ft and maximum of 12.00 lbf/sq ft.

G. Thermal Transmittance of Assembly (Excluding Entrances): Maximum U Value of 0.45 Btu/sq ft per hour per deg F when measured in accordance with AAMA 1503 and NFRC 100.

H. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over 12 hour period without causing detrimental effect to system components and anchorage.

I. System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior by weep drainage network.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work and expansion and contraction joint location and details.

C. Product Data: Submit component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, and internal drainage details.

D. Samples: Submit two samples 12 x 12 inches in size illustrating finished aluminum surface, infill panels, glazing materials.

E. Design Data: Indicate framing member structural and physical characteristics, calculations, dimensional limitations.
F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE
B. Surface Burning Characteristics:
   1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
C. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation board.

1.7 QUALIFICATIONS
A. Manufacturer and Installer: Company specializing in manufacturing aluminum glazing systems with minimum ten years documented experience, and with service facilities within 100 miles of Project.
B. Design structural support framing components under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Maryland.

1.8 PRE-INSTALLATION MEETINGS
A. Section 01 31 00 - Administrative Requirements: Pre-installation meeting.
B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND PROTECTION
A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
B. Handle Products of this section in accordance with AAMA MCWM-1 - Curtain Wall Manual #10.
C. Protect finished aluminum surfaces with wrapping or strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

1.10 ENVIRONMENTAL REQUIREMENTS
A. Section 01 60 00 - Product Requirements.
B. Do not install sealants nor glazing materials when ambient temperature is less than 40 degrees F during and 48 hours after installation.

1.11 COORDINATION
A. Section 01 31 00 - Administrative Requirements: Coordination and project conditions.

1.12 WARRANTY
A. Section 01 73 00 - Execution Requirements: Product warranties and product bonds.

08 41 00-4 ALUMINUM FRAMED STOREFRONTS  WCPS: Boonsboro High School Auditorium & Stage Renovations
B. Furnish five year manufacturer warranty for glazed units.

PART 2 PRODUCTS

2.1 ALUMINUM-FRAMED STOREFRONTS

A. Manufacturers:
2. EFCO Corp.
3. Old Castle.

B. Product Description:
1. Aluminum Frame: Thermally broken; applied glazing stops; drainage holes; internal weep drainage system. Frames for interior glazing need not to be thermally broken. Nominal 2”w x 4 ½” d.
2. Mullions: Profile of extruded aluminum with internal reinforcement of aluminum or shaped steel structural section.
3. Doors: Kawneer 350 Medium Stile aluminum framed thermally broken, insulated glass doors; 1-3/4 inches thick, nominal 6 inch wide top rail and vertical stiles, nominal 10 inch wide bottom rail (medium stile) with; square glazing stops.

2.2 COMPONENTS

A. Extruded Aluminum: ASTM B221; 6063 alloy, T5 temper typical, 6061 alloy, T6 temper for extruded structural members.

B. Sheet Aluminum: ASTM B209, 5005 alloy, H15 or H34 temper.

C. Sheet Steel: ASTM A653/A653M; galvanized to minimum G90.

D. Steel Sections: ASTM A36/A36M; shaped to suit mullion sections, galvanized.

E. Glass: Specified in Section 08 80 00.

F. Glazing Materials: As specified in Section 08 80 00.

G. Hardware: Furnish manufacturer’s standard door hardware for types of doors and applications indicated, and as specified below.
1. Weather Stripping: Polypropylene pile, continuous and replaceable.
2. Sill Sweep Strips: Resilient seal type, of neoprene compound.
3. Threshold: Specified in Section 08 71 00.
4. Hinges: Specified in Section 08 71 00.
5. Push/Pull: Specified in Section 08 71 00.
6. Panic Device: Specified in Section 08 71 00.
7. Closer: Specified in Section 08 71 00.
8. Finish: Exposed hardware to match hardware finishes specified in Section 08 71 00.
9. Lock Cylinders: Specified in Section 08 71 00.

H. Flashings: Minimum 0.032 inch thick aluminum to match mullion sections where exposed.
I. Sealant and Backing Materials:
   1. Sealant Used Within System (Not Used for Glazing): Manufacturer’s standard materials to achieve weather, moisture, and air infiltration requirements.
   2. Perimeter Sealant: Specified in Section 07 90 00.

J. Fasteners: Stainless steel.

2.3 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Arrange fasteners and attachments to conceal from view.

E. Reinforce interior horizontal head rail to receive drapery track brackets and attachments.

F. Prepare components with internal reinforcement for door hardware.

G. Reinforce framing members for imposed loads.

2.4 SHOP FINISHING

A. Clear Anodized Aluminum Surfaces: AAMA 611, AA-M12C22A41 non-specular as fabricated mechanical finish, medium matte chemical finish, and Architectural Class I 0.7 mils clear anodized coating.

B. Concealed Steel Items: Galvanized to ASTM A123/A123M; minimum 2.0 oz/sq ft coating thickness; galvanize after fabrication. Unfinished.

C. Apply bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar metals.

D. Shop and Touch-Up Primer for Steel Components: SSPC Paint 25 red oxide.

E. Touch-Up Primer for Galvanized Steel Surfaces: SSPC Paint 20 zinc rich.

F. Extent of Finish:
   1. Apply factory coating to surfaces exposed at completed assemblies.
   2. Apply finish to surfaces cut during fabrication so no natural aluminum is visible in completed assemblies, including joint edges.
   3. Apply touch-up materials recommended by coating manufacturer for field application to cut ends and minor damage to factory applied finish.
PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 - Administrative Requirements: Coordination and project conditions.

B. Verify dimensions, tolerances, and method of attachment with other Work.

C. Verify wall openings and adjoining air and vapor seal materials are ready to receive Work of this Section.

3.2 INSTALLATION


B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent Work to form water tight dam.

G. Coordinate attachment and seal of perimeter air and vapor retarder materials.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Install integral flashings and integral joint sealers.

J. Set thresholds in bed of mastic and secure.

K. Install hardware using templates provided. Refer to Section 08 71 00 for installation requirements.

L. Install infill panels using method required to achieve performance criteria.

M. Coordinate installation of glass with Section 08 80 00; separate glass from metal surfaces.

N. Coordinate installation of perimeter sealants with Section 07 90 00.

3.3 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.
C. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.4 FIELD QUALITY CONTROL
A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
B. Inspection to monitor quality of installation and glazing.
C. Test to ASTM E1105.

3.5 ADJUSTING
A. Section 01 73 00 - Execution Requirements: Testing, adjusting and balancing.
B. Adjust operating hardware for smooth operation.

3.6 CLEANING
A. Section 01 73 00 - Execution Requirements: Final cleaning.
B. Remove protective material from pre-finished aluminum surfaces.
C. Wash down surfaces with solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
D. Remove excess sealant by method acceptable to sealant manufacturer.

3.7 PROTECTION OF INSTALLED CONSTRUCTION
A. Section 01 50 00 – Construction Facilities and Temporary Controls: Protecting installed construction.
B. Protect finished Work from damage.

3.8 SCHEDULES
A. Refer to Drawings.

END OF SECTION
SECTION 08 44 00 – ALUMINUM CURTAINWALLS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes aluminum-framed curtainwall systems.

B. Related Sections:
   1. Section 07 90 00 - Joint Sealers: System perimeter sealant and back-up materials.
   2. Section 08 41 00 - Aluminum Framed Storefronts: Aluminum and glass doors.
   3. Section 08 80 00 - Glazing.
   4. Single Source Requirement: All products listed below shall be from same manufacturer.
      a. 08 41 00 - Aluminum Framed Storefronts.
      b. 08 44 00 - Aluminum Curtainwalls.

1.2 REFERENCES

A. Aluminum Association:

B. American Architectural Manufacturers Association:
   1. AAMA 501 - Methods of Test for Exterior Walls.
   9. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site.

C. American Society of Civil Engineers:

D. ASTM International:
3. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
7. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen.
11. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors by Uniform or Cyclic Static Air Pressure Difference.

E. National Fenestration Rating Council Incorporated:
1. NFRC 100 - Procedures for Determining Fenestration Product U-Factors.

F. National Fire Protection Association:

G. SSPC: The Society for Protective Coatings:
1. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).
2. SSPC Paint 25 - Red Iron Oxide, Zinc Oxide, Raw Linseed Oil, and Alkyd Primer.

H. Underwriters Laboratories Inc.:

1.3 SYSTEM DESCRIPTION

A. Aluminum-framed curtainwall system includes tubular aluminum sections with supplementary internal support framing, aluminum and glass entrances, shop fabricated, factory finished, glass and glazing, related flashings, anchorage and attachment devices.

B. System Assembly: Site assembled.
1.4 PERFORMANCE REQUIREMENTS

A. System Design: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall, including building corners.
   1. To design pressure of 25 lb/sq ft, as tested in accordance with ASTM E330.

B. Deflection: Limit mullion deflection to flexure limit of glass of span; with full recovery of glazing materials.

C. System Assembly: Accommodate without damage to components or deterioration of seals, movement within system, movement between system and peripheral construction, dynamic loading and release of loads, deflection of structural support framing.

D. Air Infiltration: Limit air leakage through assembly to 0.06 cfm/min/sq ft of wall area, measured at reference differential pressure across assembly of 1.57 psf as measured in accordance with ASTM E283.

E. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glass and inner sheet of infill panel and heel bead of glazing compound.

F. Water Leakage: None, when measured in accordance with ASTM E331 with test pressure difference of 20 percent of design pressure, with minimum differential of 2.86 lbf/sq ft and maximum of 12.00 lbf/sq ft.

G. Thermal Transmittance of Assembly (Excluding Entrances): Maximum U Value of 0.45 Btu/sq ft per hour per deg F when measured in accordance with AAMA 1503 and NFRC 100.

H. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over 12 hour period without causing detrimental effect to system components and anchorage.

I. System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior by weep drainage network.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work and expansion and contraction joint location and details.

C. Product Data: Submit component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, and internal drainage details.

D. Samples: Submit two samples 12 x 12 inches in size illustrating finished aluminum surface, infill panels, glazing materials.
E. Design Data: Indicate framing member structural and physical characteristics, calculations, dimensional limitations.
F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE
B. Surface Burning Characteristics:
   1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
C. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation board.

1.7 QUALIFICATIONS
A. Manufacturer and Installer: Company specializing in manufacturing aluminum glazing systems with minimum ten years documented experience, and with service facilities within 100 miles of Project.
B. Design structural support framing components under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Maryland.

1.8 PRE-INSTALLATION MEETINGS
A. Section 01 31 00 - Administrative Requirements: Pre-installation meeting.
B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND PROTECTION
A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
B. Handle Products of this section in accordance with AAMA MCWM-1 - Curtain Wall Manual #10.
C. Protect finished aluminum surfaces with wrapping or strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

1.10 ENVIRONMENTAL REQUIREMENTS
A. Section 01 60 00 - Product Requirements.
B. Do not install sealants nor glazing materials when ambient temperature is less than 40 degrees F during and 48 hours after installation.
1.11 COORDINATION

A. Section 01 31 00 - Administrative Requirements: Coordination and project conditions.

1.12 WARRANTY

A. Section 01 73 00 - Execution Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for glazed units.

PART 2 PRODUCTS

2.1 ALUMINUM-FRAMED STOREFRONTS

A. Manufacturers:
   2. EFCO Corp.
   3. Old Castle.

B. Product Description:
   1. Aluminum Frame: Thermally broken; applied glazing stops; drainage holes; internal weep drainage system. Frames for interior glazing need not to be thermally broken. Nominal 2-1/2”w x 7-1/2” d.
   2. Mullions: Profile of extruded aluminum with internal reinforcement of aluminum or shaped steel structural section.

2.2 COMPONENTS

A. Extruded Aluminum: ASTM B221; 6063 alloy, T5 temper typical, 6061 alloy, T6 temper for extruded structural members.

B. Sheet Aluminum: ASTM B209, 5005 alloy, H15 or H34 temper.

C. Sheet Steel: ASTM A653/A653M; galvanized to minimum G90.

D. Steel Sections: ASTM A36/A36M; shaped to suit mullion sections, galvanized.

E. Glass: Specified in Section 08 80 00.

F. Glazing Materials: As specified in Section 08 80 00.

G. Flashings: Minimum 0.032 inch thick aluminum to match mullion sections where exposed.

H. Sealant and Backing Materials:
   1. Sealant Used within System (Not Used for Glazing): Manufacturer’s standard materials to achieve weather, moisture, and air infiltration requirements.
   2. Perimeter Sealant: Specified in Section 07 90 00.
I. Fasteners: Stainless steel.

2.3 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Arrange fasteners and attachments to conceal from view.

E. Reinforce interior horizontal head rail to receive drapery track brackets and attachments.

F. Prepare components with internal reinforcement for door hardware.

G. Reinforce framing members for imposed loads.

2.4 SHOP FINISHING

A. Clear Anodized Aluminum Surfaces: AAMA 611, AA-M12C22A41 non-specular as fabricated mechanical finish, medium matte chemical finish, and Architectural Class I 0.7 mils clear anodized coating.

B. Concealed Steel Items: Galvanized to ASTM A123/A123M; minimum 2.0 oz/sq ft coating thickness; galvanize after fabrication. Unfinished.

C. Apply bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar metals.

D. Shop and Touch-Up Primer for Steel Components: SSPC Paint 25 red oxide.

E. Touch-Up Primer for Galvanized Steel Surfaces: SSPC Paint 20 zinc rich.

F. Extent of Finish:
   1. Apply factory coating to surfaces exposed at completed assemblies.
   2. Apply finish to surfaces cut during fabrication so no natural aluminum is visible in completed assemblies, including joint edges.
   3. Apply touch-up materials recommended by coating manufacturer for field application to cut ends and minor damage to factory applied finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 - Administrative Requirements: Coordination and project conditions.
B. Verify dimensions, tolerances, and method of attachment with other Work.

C. Verify wall openings and adjoining air and vapor seal materials are ready to receive Work of this Section.

3.2 INSTALLATION


B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent Work to form water tight dam.

G. Coordinate attachment and seal of perimeter air and vapor retarder materials.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Install integral flashings and integral joint sealers.

J. Set thresholds in bed of mastic and secure.

K. Install hardware using templates provided. Refer to Section 08 71 00 for installation requirements.

L. Install infill panels using method required to achieve performance criteria.

M. Coordinate installation of glass with Section 08 80 00; separate glass from metal surfaces.

N. Coordinate installation of perimeter sealants with Section 07 90 00.

3.3 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.

C. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.
3.4 FIELD QUALITY CONTROL
A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
B. Inspection to monitor quality of installation and glazing.
C. Test to ASTM E1105.

3.5 ADJUSTING
A. Section 01 73 00 - Execution Requirements: Testing, adjusting and balancing.
B. Adjust operating hardware for smooth operation.

3.6 CLEANING
A. Section 01 73 00 - Execution Requirements: Final cleaning.
B. Remove protective material from pre-finished aluminum surfaces.
C. Wash down surfaces with solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
D. Remove excess sealant by method acceptable to sealant manufacturer.

3.7 PROTECTION OF INSTALLED CONSTRUCTION
A. Section 01 50 00 – Construction Facilities and Temporary Controls: Protecting installed construction.
B. Protect finished Work from damage.

3.8 SCHEDULES
A. Refer to Drawings.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:
   1. Swinging doors.
   2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Electromechanical door hardware.
   3. Cylinders specified for doors in other sections.

C. Related Sections:
   1. Section 08 11 13 - Hollow Metal Doors and Frames
   2. Section 08 21 00 - Wood Doors
   3. Section 08 41 00 - Aluminum Framed Storefronts
   4. Section 28 13 00 - Access Control

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   6. NFPA 105 - Installation of Smoke Door Assemblies.
   7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:
   1. ANSI/BHMA Certified Product Standards - A156 Series
   2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:
   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.
   h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:
   1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
      a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
      b. Complete (risers, point-to-point) access control system block wiring diagrams.
      c. Wiring instructions for each electronic component scheduled herein.
   2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:
   1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.
1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
   1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
   2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
   1. Function of building, purpose of each area and degree of security required.
   2. Plans for existing and future key system expansion.
   3. Requirements for key control storage and software.
   4. Installation of permanent keys, cylinder cores and software.
   5. Address and requirements for delivery of keys.

G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
   1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
   2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
   3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures.

H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
   1. Structural failures including excessive deflection, cracking, or breakage.
   2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:
   1. Ten years for mortise locks and latches.
   2. Five years for exit hardware.
   3. Twenty five years for manual surface door closer bodies.
   4. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
   1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
   1. Quantity: Provide the following hinge quantity:
      a. Two Hinges: For doors with heights up to 60 inches.
      b. Three Hinges: For doors with heights 61 to 90 inches.
      c. Four Hinges: For doors with heights 91 to 120 inches.
      d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
   2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
      a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
   a. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:
   a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:
   a. Bommer Industries (BO).
   b. Ives (IV).
   c. McKinney Products (MK).

B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge, with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
   1. Manufacturers:
      b. Pemko Products (PE).
      c. Select Products (SE).

2.3 POWER TRANSFER DEVICES

A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
   1. Manufacturers:
      a. Architectural Builders Hardware (AH) - PT1000-EZ Series.
      b. Pemko Products (PE) - EL-CEPT Series.
      c. Securitron (SU) - EL-CEPT Series.

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
   1. Provide one each of the following tools as part of the base bid contract:
      b. McKinney Products (MK) - Connector Hand Tool: QC-R003.
   2. Manufacturers:
      a. McKinney Products (MK) - QC-C Series.
2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
   1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
   2. Furnish dust proof strikes for bottom bolts.
   3. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
   4. Manufacturers:
      a. Door Controls International (DC).
      b. Rockwood Products (RO).
      c. Trimco (TC).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. All exterior locks and cylinders to be Grandmaster or Masterkeyed to the existing Washington County Public Schools Corbin Russwin Pyramid PS removable core key system as required by the owner.

C. All interior locks and cylinders to be Grandmaster or Masterkeyed to the existing Washington County Public Schools Corbin Russwin D1 key system as required by the owner.

D. Cylinders: Original manufacturer cylinders complying with the following:
   1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
   2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
   3. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.

E. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
   1. Removable Cores: Core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware. Provide removable core (small or large format) as specified in Hardware Sets.

F. Security Cylinders: ANSI/BHMA A156.5, Grade 1, patterned security cylinders and keys able to be used together under the same facility master or grandmaster key system. Cylinders are to be factory keyed.
   1. Manufacturers:
      a. Corbin Russwin (RU) - Pyramid PS Series.
      b. To Meet Owners Requirements.

G. Keying System: Each type of lock and cylinders to be factory keyed.
   1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Key locks to Owner's existing Corbin Russwin system.

H. Key Quantity: Provide the following minimum number of keys:
1. Change Keys per Cylinder: Three (3) each.
2. Master Keys (per Master Key Level/Group): Five (5) each.
3. Construction Keys: Ten (10) each.
4. Construction Control Keys: Two (2) each.
5. Permanent Control Keys: Two (2) each.

I. Construction Keying: Provide construction master keyed cylinders as required.

J. Construction Keying: Provide temporary keyed brass construction cores as required.

K. Key Registration List (Bitting List):
1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.
1. Manufacturers:
   a. Corbin Russwin Hardware (RU) - ML2000 Series.
   b. To Meet Owners Requirements.

2.7 ELECTROMECHANICAL LOCKING DEVICES

A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below.
1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.
2. Manufacturers:
   a. Corbin Russwin Hardware (RU) - ML20900 Series.
   b. To Meet Owners Requirements.

2.8 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
B. Standards: Comply with the following:
2. Dustproof Strikes: BHMA A156.16.

2.9 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.
3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
5. Flush End Caps: Provide flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.
6. Electromechanical Options: Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified in hardware sets. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.
7. Motorized Electric Latch Retraction: Devices with an electric latch retraction feature must use motors which have a maximum current draw of 600mA. Solenoid driven latch retraction is not acceptable.
8. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
   a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
   b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
9. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
10. Extended cycle test: Devices to have been cycle tested in ordinance with ANSI/BHMA 156.3 requirements to 9 million cycles.
11. Rail Sizing: Provide exit device rails factory sized for proper door width application.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Manufacturers:
   a. Corbin Russwin Hardware (RU) - ED5000 Series.
b. To Meet Owners Requirements.

C. Security Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified rim panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be constructed of high grade, heat treated, corrosion resistant nickel steel alloy, and have a full 3/4" throw projection with slide action positive deadlocking.
   2. Manufacturers:
      a. Corbin Russwin Hardware (RU) - ED5000S Series.
      b. To Meet Owners Requirements.

D. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish.
   1. Provide keyed removable feature where specified in the Hardware Sets.
   2. Provide stabilizers and mounting brackets as required.
   3. Provide electrical quick connection wiring options as specified in the hardware sets.
   4. Manufacturers:
      a. Corbin Russwin Hardware (RU) - 900 Series.
      b. To Meet Owners Requirements.

2.10 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:
   1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
   2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
   3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
   4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
   5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
   6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
   7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
   1. Manufacturers:
      a. Corbin Russwin Hardware (RU) - DC6000 Series.
b. To Meet Owners Requirements.

C. Door Closers, Surface Mounted (Cam Action): ANSI/BHMA 156.4, Grade 1 certified surface mounted, high efficiency door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be of the cam and roller design, one piece cast aluminum silicon alloy body with adjustable backcheck and independently controlled valves for closing sweep and latch speed.
   1. Manufacturers:
      a. Corbin Russwin (RU) - DC5000 Series.
      b. To Meet Owners Requirements.

2.11 ARCHITECTURAL TRIM

A. Door Protective Trim
   1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
   2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
   3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.
   4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
      a. Stainless Steel: 300 grade, 050-inch thick.
   5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
   6. Manufacturers:
      a. Hiawatha, Inc. (HI).
      b. Rockwood Products (RO).
      c. Trimco (TC).

2.12 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
   1. Manufacturers:
      a. Hiawatha, Inc. (HI).
      b. Rockwood Products (RO).
      c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber
spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:
   a. Glynn Johnson (GJ).
   b. Rixson Door Controls (RF).
   c. Sargent Manufacturing (SA).

2.13 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
   1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
   1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

E. Manufacturers:
   1. National Guard Products (NG).
   2. Pemko Products (PE).

2.14 ELECTRONIC ACCESSORIES

A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.
   1. Manufacturers:
      a. Sargent Manufacturing (SA) - 3280 Series.
      b. Security Door Controls (SD) - DPS Series.
      c. Securitron (SU) - DPS Series.

B. Switching Power Supplies: Provide switching power supplies that are dual voltage, UL listed, supervised units. Units shall be field selectable with a dedicated battery charging circuit that provide 4 Amp at 12VDC or 24VDC continuous, with up to 16 independently controlled power limited outputs. Units shall tolerate brownout or overvoltage input ± 15% of nominal voltage and have thermal shutdown protection with auto restart. Circuit breaker shall protect against overcurrent and reverse battery faults.
and units shall be available with a single relay fire trigger or individually triggered relaying outputs. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Manufacturers:
   a. Securitron (SU) - AQ Series.

2.15 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.16 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.17 EXISTING HARDWARE

A. All hardware for doors listed as existing to remain in the door schedule or in the hardware sets will remain. The general contractor shall clean and adjust these items for proper alignment and operation.

2.18 EXISTING HARDWARE PREPS

A. The general contractor shall verify that all new hardware specified for existing doors and frames will be compatible with the existing hardware preparations. Lack of verification prior to bid, that requires additional work to the existing doors and frames or additional material, will be the responsibility of the general contractor.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.
3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.


3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
   1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
   2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
   3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
   4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.

Set: 1 – Exterior Entry

Doors: 100A

<table>
<thead>
<tr>
<th>Set</th>
<th>Description</th>
<th>Model/Brand</th>
<th>Unit Qty.</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Continuous Hinge</td>
<td>CFM83SLF-HD1</td>
<td>630</td>
<td>PE</td>
</tr>
<tr>
<td>2</td>
<td>Exit Device</td>
<td>ED5200S x VT950ET x temporary core x M52 x M110 x CMK</td>
<td>689</td>
<td>RU</td>
</tr>
<tr>
<td>1</td>
<td>Removable Mullion</td>
<td>CR910KM x 120&quot; x temporary core x CMK</td>
<td>652</td>
<td>RF</td>
</tr>
<tr>
<td></td>
<td>(Removable mullion to be cut to size in the field)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Permanent Core</td>
<td>CR8027 x MK</td>
<td>626</td>
<td>RU</td>
</tr>
<tr>
<td>2</td>
<td>Closer</td>
<td>DC6210 A3 x M77</td>
<td>689</td>
<td>RU</td>
</tr>
<tr>
<td>2</td>
<td>Mounting Plate</td>
<td>597F58</td>
<td>689</td>
<td>RU</td>
</tr>
<tr>
<td>2</td>
<td>Overhead Stop</td>
<td>1-X36 x 90 deg</td>
<td>652</td>
<td>RF</td>
</tr>
<tr>
<td>1</td>
<td>Threshold</td>
<td>1715 A x DOW x MS &amp; ES25</td>
<td>689</td>
<td>RF</td>
</tr>
<tr>
<td></td>
<td>(Threshold to be notched for removable mullion in the field)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Mullion Door Seal</td>
<td>5110 BL x DOH</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Door Bottom Seal</td>
<td>345 AV x DOW</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Drip Strip</td>
<td>346 C x DOW + 4&quot;</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Door Position Switch</td>
<td>DPS-M-BK</td>
<td>SU</td>
<td></td>
</tr>
</tbody>
</table>

Gasketing furnished by frame manufacturer
Set: 1.1 – Exterior Entry

Doors: 100B

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Continuous Hinge</td>
<td>CFM83SLF-HD1</td>
<td>PE</td>
</tr>
<tr>
<td>1 Power Transfer</td>
<td>EL-CEPT</td>
<td>SU</td>
</tr>
<tr>
<td>(For active leaf of pair only)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 ElectroLynx Harness</td>
<td>QC-C1500P</td>
<td>MK</td>
</tr>
<tr>
<td>(Install between power transfer and junction box)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Electric Latch Retraction Exit</td>
<td>ED5200S x VT957ET x temporary core x 630 RU</td>
<td>RU</td>
</tr>
<tr>
<td>Device (Fail Secure)</td>
<td>M52 x MELR x M110 x CMK x 24VDC</td>
<td></td>
</tr>
<tr>
<td>1 ElectroLynx Harness</td>
<td>QC-CXXX x required length</td>
<td>MK</td>
</tr>
<tr>
<td>(Install between power transfer and electric latch retraction exit device)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Exit Device</td>
<td>ED5200S x VT950ET x temporary core x 630 RU</td>
<td>RU</td>
</tr>
<tr>
<td>M52 x M110 x CMK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Removable Mullion</td>
<td>CR910KM x 120&quot; x temporary core x CMK</td>
<td>RU</td>
</tr>
<tr>
<td>(Removable mullion to be cut to size in the field)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Permanent Core</td>
<td>CR8027 x MK</td>
<td>626 RU</td>
</tr>
<tr>
<td>2 Closer</td>
<td>DC6210 A3 x M77</td>
<td>689 RU</td>
</tr>
<tr>
<td>2 Mounting Plate</td>
<td>597F58</td>
<td>689 RU</td>
</tr>
<tr>
<td>2 Overhead Stop</td>
<td>1-X36 x 90 deg</td>
<td>652 RF</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>1715 A x DOW x MS &amp; ES25</td>
<td>PE</td>
</tr>
<tr>
<td>(Threshold to be notched for removable mullion in the field)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Mullion Door Seal</td>
<td>5110 BL x DOH</td>
<td>PE</td>
</tr>
<tr>
<td>2 Door Bottom Seal</td>
<td>345 AV x DOW</td>
<td>PE</td>
</tr>
<tr>
<td>1 Drip Strip</td>
<td>346 C x DOW + 4&quot;</td>
<td>PE</td>
</tr>
<tr>
<td>1 Card Reader</td>
<td>Furnished and installed by security contractor</td>
<td>OT</td>
</tr>
<tr>
<td>2 Door Position Switch</td>
<td>DPS-M-BK</td>
<td>SU</td>
</tr>
<tr>
<td>1 Power Supply</td>
<td>AQU4</td>
<td>SU</td>
</tr>
<tr>
<td>1 Wiring Diagram</td>
<td>WD-SYSPK</td>
<td>RU</td>
</tr>
</tbody>
</table>

Gasketing furnished by frame manufacturer
Card reader to be used by authorized persons to gain entry from the exterior side of the opening
Card reader to be used to retract the latch of the electric latch retraction exit device
Push bar of exit devices always free for immediate egress

Set: 1.2 – Entry Vestibule

Doors: 103A

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Continuous Hinge</td>
<td>CFM83SLF-HD1</td>
<td>PE</td>
</tr>
<tr>
<td>2 Exit Device</td>
<td>ED5200S x VT950ET x temporary core x 630 RU</td>
<td>RU</td>
</tr>
<tr>
<td>M52 x M110 x CMK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Removable Mullion</td>
<td>CR910KM x 120&quot; x D1 keyway x CMK x MK</td>
<td>RU</td>
</tr>
<tr>
<td>(Removable mullion to be cut to size in the field)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Closer</td>
<td>DC6210 A3 x M77</td>
<td>689 RU</td>
</tr>
<tr>
<td>2 Mounting Plate</td>
<td>597F58</td>
<td>689 RU</td>
</tr>
<tr>
<td>2 Overhead Stop</td>
<td>1-X36 x 90 deg</td>
<td>652 RF</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>1715 A x DOW x MS &amp; ES25</td>
<td>PE</td>
</tr>
<tr>
<td>(Threshold to be notched for removable mullion in the field)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Mullion Door Seal</td>
<td>5110 BL x DOH</td>
<td>PE</td>
</tr>
<tr>
<td>2 Door Bottom Seal</td>
<td>321 CN x DOW</td>
<td>PE</td>
</tr>
<tr>
<td>1 Astragal (Set)</td>
<td>(2) 297 AS x DOH</td>
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</tr>
<tr>
<td>2 Door Position Switch</td>
<td>DPS-M-BK</td>
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</table>

Gasketing furnished by frame manufacturer
## Set: 1.3 – Entry Vestibule

Doors: 103B

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td>2 Continuous Hinge</td>
<td>CFM83SLF-HD1</td>
<td>PE</td>
</tr>
<tr>
<td>1 Power Transfer</td>
<td>EL-CEPT</td>
<td>SU</td>
</tr>
<tr>
<td><strong>(For active leaf of pair only)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 ElectroLynx Harness</td>
<td>QC-C1500P</td>
<td>MK</td>
</tr>
<tr>
<td><strong>(Install between power transfer and junction box)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Electric Latch Retraction Exit</td>
<td>ED5200S x VT957ET x D1 keyway x M52 x 630 RU</td>
<td>RU</td>
</tr>
<tr>
<td>Device (Fail Secure)</td>
<td>MELR x M110 x CMK x 24VDC</td>
<td></td>
</tr>
<tr>
<td>1 ElectroLynx Harness</td>
<td>QC-CXXX x required length</td>
<td>MK</td>
</tr>
<tr>
<td><strong>(Install between power transfer and electric latch retraction exit device)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Exit Device</td>
<td>ED5200S x VT950ET x D1 keyway x M52 x M110 x CMK</td>
<td>RU</td>
</tr>
<tr>
<td>1 Removable Mullion</td>
<td>CR910KM x 120&quot; x D1 keyway x CMK x MK</td>
<td>RU</td>
</tr>
<tr>
<td><strong>(Removable mullion to be cut to size in the field)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Closer</td>
<td>DC6210 A3 x M77</td>
<td>689 RU</td>
</tr>
<tr>
<td>2 Mounting Plate</td>
<td>597F58</td>
<td>689 RU</td>
</tr>
<tr>
<td>2 Overhead Stop</td>
<td>1-X36 x 90 deg</td>
<td>652 RF</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>1715 A x DOW x MS &amp; ES25</td>
<td>PE</td>
</tr>
<tr>
<td><strong>(Threshold to be notched for removable mullion in the field)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Mullion Door Seal</td>
<td>5110 BL x DOH</td>
<td>PE</td>
</tr>
<tr>
<td>2 Door Bottom Seal</td>
<td>321 CN x DOW</td>
<td>PE</td>
</tr>
<tr>
<td>1 Card Reader</td>
<td>Furnished and installed by security contractor</td>
<td>OT</td>
</tr>
<tr>
<td>2 Door Position Switch</td>
<td>DPS-M-BK</td>
<td>SU</td>
</tr>
<tr>
<td>1 Power Supply</td>
<td>AQD4</td>
<td>SU</td>
</tr>
<tr>
<td>1 Wiring Diagram</td>
<td>WD-SYSPK</td>
<td>RU</td>
</tr>
</tbody>
</table>

*Gasketing furnished by frame manufacturer*

Card reader to be used by authorized persons to gain entry from the pull side of the opening
Card reader to be used to retract the latch of the electric latch retraction exit device
Push bar of exit devices always free for immediate egress

## Set: 2 – Exterior Entry

Doors: 101

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Continuous Hinge</td>
<td>CFM83SLF-HD1</td>
<td>PE</td>
</tr>
<tr>
<td>1 Power Transfer</td>
<td>EL-CEPT</td>
<td>SU</td>
</tr>
<tr>
<td>1 ElectroLynx Harness</td>
<td>QC-C1500P</td>
<td>MK</td>
</tr>
<tr>
<td><strong>(Install between power transfer and junction box)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Electrified Lockset (Fail Secure)</td>
<td>ML20906-SEC x NSA x temporary core x 626 CMK x MK</td>
<td>RU</td>
</tr>
<tr>
<td>1 ElectroLynx Harness</td>
<td>QC-CXXX x required length</td>
<td>MK</td>
</tr>
<tr>
<td><strong>(Install between power transfer and electrified lockset)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Permanent Core</td>
<td>CR8027 x MK</td>
<td>626 RU</td>
</tr>
<tr>
<td>1 Closer</td>
<td>DC6210 A3 x M77</td>
<td>689 RU</td>
</tr>
<tr>
<td>1 Mounting Plate</td>
<td>597F58</td>
<td>689 RU</td>
</tr>
<tr>
<td>1 Overhead Stop</td>
<td>1-X36 x 90 deg</td>
<td>652 RF</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>1715 A x DOW x MS &amp; ES25</td>
<td>PE</td>
</tr>
<tr>
<td>1 Door Bottom Seal</td>
<td>345 AV x DOW</td>
<td>PE</td>
</tr>
<tr>
<td>1 Drip Strip</td>
<td>346 C x DOW + 4&quot;</td>
<td>PE</td>
</tr>
<tr>
<td>1 Card Reader</td>
<td>Furnished and installed by security contractor</td>
<td>OT</td>
</tr>
<tr>
<td>1 Aiphone System</td>
<td>Furnished and installed by security contractor</td>
<td>OT</td>
</tr>
<tr>
<td>1 Door Position Switch</td>
<td>DPS-M-BK</td>
<td>SU</td>
</tr>
<tr>
<td>1 Power Supply</td>
<td>AQD4</td>
<td>SU</td>
</tr>
<tr>
<td>1 Wiring Diagram</td>
<td>WD-SYSPK</td>
<td>RU</td>
</tr>
</tbody>
</table>

WCPS: Boonsboro High School
Auditorium & Stage Renovations

DOOR HARDWARE 08 71 00 - 17
Gasketing furnished by frame manufacturer
Card reader to be used by authorized persons to gain entry from the exterior side of the opening
Card reader to be used to unlock the pull side lever of the electrified lockset
Pull side lever of the electrified lockset to be unlocked from a remote location
Push side lever of the electrified lockset always free for immediate egress

**Set: 2.1 – Entry Vestibule**

Doors: 102

<table>
<thead>
<tr>
<th>Item</th>
<th>Model/Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Hinge</td>
<td>CFM83SLF-HD1</td>
<td>PE</td>
</tr>
<tr>
<td>Power Transfer</td>
<td>EL-CEPT</td>
<td>SU</td>
</tr>
<tr>
<td>ElectroLynx Harness</td>
<td>QC-C1500P</td>
<td>MK</td>
</tr>
<tr>
<td>Electrified Lockset (Fail Secure)</td>
<td>ML20906-SEC x NSA x D1 keyway x CMK x MK</td>
<td>RU</td>
</tr>
<tr>
<td>ElectroLynx Harness</td>
<td>QC-CXXX x required length</td>
<td>MK</td>
</tr>
<tr>
<td>Closer</td>
<td>DC6210 A3 x M77</td>
<td>RU</td>
</tr>
<tr>
<td>Mounting Plate</td>
<td>597F58</td>
<td>RU</td>
</tr>
<tr>
<td>Overhead Stop</td>
<td>1-X36 x 90 deg</td>
<td>RF</td>
</tr>
<tr>
<td>Threshold</td>
<td>1715 A x DOW x MS &amp; ES25</td>
<td>PE</td>
</tr>
<tr>
<td>Door Bottom Seal</td>
<td>321 CN x DOW</td>
<td>PE</td>
</tr>
<tr>
<td>Door Position Switch</td>
<td>DPS-M-BK</td>
<td>SU</td>
</tr>
<tr>
<td>Wiring Diagram</td>
<td>WD-SYSPK</td>
<td>RU</td>
</tr>
</tbody>
</table>

Gasketing furnished by frame manufacturer
Pull side lever of the electrified lockset to be unlocked from a remote location
Push side lever of the electrified lockset always free for immediate egress

**Set: 3 – Projection**

Doors: 104A

<table>
<thead>
<tr>
<th>Item</th>
<th>Model/Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinge</td>
<td>T4A3786 4-1/2&quot; x 4-1/2&quot; NRP</td>
<td>US26D MK</td>
</tr>
<tr>
<td>Storeroom Lockset</td>
<td>ML2057 NSA x D1 keyway x CMK x MK</td>
<td>RU</td>
</tr>
<tr>
<td>Closer/Stop</td>
<td>DC6210 A11</td>
<td>RU</td>
</tr>
<tr>
<td>Kickplate</td>
<td>K1050 10&quot; x 2&quot; LDW 4BE CSK</td>
<td>US32D RO</td>
</tr>
<tr>
<td>Threshold</td>
<td>151 A x DOW x MS &amp; ES25</td>
<td>PE</td>
</tr>
<tr>
<td>Gasketing (Set)</td>
<td>S88 BL x DOW x DOH</td>
<td>PE</td>
</tr>
<tr>
<td>Automatic Door Bottom</td>
<td>434 APKL x DOW</td>
<td>PE</td>
</tr>
</tbody>
</table>

Existing frame to remain
The general contractor shall verify that all new hardware will work with existing frame conditions

**Set: 4 – Auditorium**

Doors: 107A, 107B

<table>
<thead>
<tr>
<th>Item</th>
<th>Model/Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security Classroom Exit Device</td>
<td>ED5202 x N955ET x D1 keyway x M52 x M110 x CMK x MK</td>
<td>RU</td>
</tr>
<tr>
<td>Exit Device</td>
<td>ED5200 x N950ET x D1 keyway x M52 x M110 x CMK x MK</td>
<td>RU</td>
</tr>
<tr>
<td>Removable Mullion</td>
<td>CR910KM x 120&quot; x D1 keyway x CMK x MK</td>
<td>RU</td>
</tr>
<tr>
<td>Closer/Holder</td>
<td>DC6210 A12</td>
<td>RU</td>
</tr>
<tr>
<td>Kickplate</td>
<td>K1050 10&quot; x 2&quot; LDW 4BE CSK</td>
<td>US32D RO</td>
</tr>
<tr>
<td>Threshold</td>
<td>151 A x DOW x MS &amp; ES25</td>
<td>PE</td>
</tr>
</tbody>
</table>

08 71 00 - 18 DOOR HARDWARE WCPS: Boonsboro High School Auditorium & Stage Renovations
Set: 5 – Auditorium/Stage

Existing frame to remain
The general contractor shall verify that all new hardware will work with existing frame conditions

Set: 6 – Auditorium

Existing frame to remain
The general contractor shall verify that all new hardware will work with existing frame conditions

Set: 7 – Storage

Balance of hardware to be determined
Existing frame to remain
The general contractor shall verify that all new hardware will work with existing frame conditions
### Set: 8 – Stage

**Doors: 109C**

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Description</th>
<th>Finish</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>8</strong> Hinge</td>
<td>1</td>
<td>T4A3786 4-1/2&quot; x 4-1/2&quot; NRP</td>
<td>US26D</td>
<td>MK</td>
</tr>
<tr>
<td><strong>1</strong> Exit Device</td>
<td>1</td>
<td>ED5470B x N955ET x D1 keyway x M55 x M110 x CMK x MK</td>
<td>630</td>
<td>RU</td>
</tr>
<tr>
<td><strong>1</strong> Exit Device</td>
<td>1</td>
<td>ED5470B x M55 x M110</td>
<td>630</td>
<td>RU</td>
</tr>
<tr>
<td><strong>2</strong> Closer</td>
<td>1</td>
<td>DC6210 A3</td>
<td>689</td>
<td>RU</td>
</tr>
<tr>
<td><strong>2</strong> Kickplate</td>
<td>1</td>
<td>K1050 10&quot; x 1&quot; LDW 4BE CSK</td>
<td>US32D</td>
<td>RO</td>
</tr>
<tr>
<td><strong>2</strong> Wall Stop</td>
<td>1</td>
<td>406</td>
<td>US32D</td>
<td>RO</td>
</tr>
<tr>
<td><strong>1</strong> Threshold</td>
<td>1</td>
<td>151 A x DOW x MS &amp; ES25</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td><strong>1</strong> Gasketing (Set)</td>
<td>1</td>
<td>S88 BL x DOW x DOH</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td><strong>2</strong> Door Bottom Seal</td>
<td>1</td>
<td>234 AV x DOW</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td><strong>1</strong> Astragal (Set)</td>
<td>1</td>
<td>(2) 297 AS x DOH</td>
<td>PE</td>
<td></td>
</tr>
</tbody>
</table>

### Set: 9 – Choral

**Doors: 113A**

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Description</th>
<th>Finish</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3</strong> Hinge</td>
<td>1</td>
<td>T4A3786 4-1/2&quot; x 4-1/2&quot; NRP</td>
<td>US26D</td>
<td>MK</td>
</tr>
<tr>
<td><strong>1</strong> Exit Device</td>
<td>1</td>
<td>ED5202 x N955ET x D1 keyway x M52 x M110 x CMK x MK</td>
<td>630</td>
<td>RU</td>
</tr>
<tr>
<td><strong>1</strong> Closer</td>
<td>1</td>
<td>DC6210 A3 x M77</td>
<td>689</td>
<td>RU</td>
</tr>
<tr>
<td><strong>1</strong> Door Stop &amp; Holder</td>
<td>1</td>
<td>494R</td>
<td>US26D</td>
<td>RO</td>
</tr>
<tr>
<td><strong>1</strong> Threshold</td>
<td>1</td>
<td>151 A x DOW x MS &amp; ES25</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td><strong>1</strong> Door Bottom Seal</td>
<td>1</td>
<td>234 AV x DOW</td>
<td>PE</td>
<td></td>
</tr>
</tbody>
</table>

*Gasketing furnished by frame manufacturer*

### Set: 10 – Storage

**Doors: 114A**

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Description</th>
<th>Finish</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3</strong> Hinge</td>
<td>1</td>
<td>T4A3786 4-1/2&quot; x 4-1/2&quot; NRP</td>
<td>US26D</td>
<td>MK</td>
</tr>
<tr>
<td><strong>1</strong> Storeroom Lockset</td>
<td>1</td>
<td>ML2057 NSA x D1 keyway x CMK x MK</td>
<td>626</td>
<td>RU</td>
</tr>
<tr>
<td><strong>1</strong> Kickplate</td>
<td>1</td>
<td>K1050 10&quot; x 2&quot; LDW 4BE CSK</td>
<td>US32D</td>
<td>RO</td>
</tr>
<tr>
<td><strong>1</strong> Overhead Stop</td>
<td>1</td>
<td>9-X36 x 90 deg</td>
<td>652</td>
<td>RF</td>
</tr>
<tr>
<td><strong>3</strong> Silencer</td>
<td>1</td>
<td>608-RKW</td>
<td>RO</td>
<td></td>
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</tbody>
</table>

### Set: 11 – Exterior Storage

**Doors: 114B**

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Description</th>
<th>Finish</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2</strong> Continuous Hinge</td>
<td>1</td>
<td>CFM120HD1</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td><strong>1</strong> Storeroom Lockset</td>
<td>1</td>
<td>ML2057 NSA x temporary core x CMK x MK</td>
<td>626</td>
<td>RU</td>
</tr>
<tr>
<td><strong>1</strong> Permanent Core</td>
<td>1</td>
<td>CR8027 x MK</td>
<td>626</td>
<td>RU</td>
</tr>
<tr>
<td><strong>1</strong> Automatic Flush Bolt (Top)</td>
<td>1</td>
<td>2840</td>
<td>US26D</td>
<td>RO</td>
</tr>
<tr>
<td><strong>1</strong> Flush Bolt</td>
<td>1</td>
<td>555 x 12&quot;</td>
<td>US26D</td>
<td>RO</td>
</tr>
<tr>
<td><strong>1</strong> Closer</td>
<td>1</td>
<td>DC6210 A13</td>
<td>689</td>
<td>RU</td>
</tr>
<tr>
<td><strong>2</strong> Armor Plate</td>
<td>1</td>
<td>K1050 30&quot; x 1&quot; LDW 4BE CSK</td>
<td>US32D</td>
<td>RO</td>
</tr>
<tr>
<td><strong>2</strong> Overhead Holder</td>
<td>1</td>
<td>9-X26 x 90 deg</td>
<td>652</td>
<td>RF</td>
</tr>
<tr>
<td><strong>1</strong> Threshold</td>
<td>1</td>
<td>1715 A x DOW x MS &amp; ES25</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td><strong>1</strong> Gasketing (Set)</td>
<td>1</td>
<td>316 AS x DOW x DOH</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td><strong>2</strong> Door Bottom Seal</td>
<td>1</td>
<td>345 AV x DOW</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td><strong>1</strong> Astragal</td>
<td>1</td>
<td>355 CS x DOH</td>
<td>PE</td>
<td></td>
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<tr>
<td><strong>1</strong> Drip Strip</td>
<td>1</td>
<td>346 C x DOW + 4&quot;</td>
<td>PE</td>
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</table>

08 71 00 - 20 DOOR HARDWARE

WCPS: Boonsboro High School
Auditorium & Stage Renovations
<table>
<thead>
<tr>
<th>Set: 12 – Corridor Toilet</th>
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</thead>
<tbody>
<tr>
<td>Doors: 116, 117</td>
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<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Hinge</td>
<td>T4A3786 4-1/2&quot; x 4-1/2&quot;</td>
<td></td>
<td>US26D</td>
</tr>
<tr>
<td>1 Privacy Set &amp; Indicator</td>
<td>ML2060 NSA x M19V</td>
<td></td>
<td>RU</td>
</tr>
<tr>
<td>1 Closer</td>
<td>DC5230</td>
<td></td>
<td>RU</td>
</tr>
<tr>
<td>1 Kickplate</td>
<td>K1050 10&quot; x 2&quot; LDW 4BE CSK</td>
<td></td>
<td>RO</td>
</tr>
<tr>
<td>1 Mop Plate</td>
<td>K1050 4&quot; x 1&quot; LDW 4BE CSK</td>
<td></td>
<td>RO</td>
</tr>
<tr>
<td>1 Door Stop</td>
<td>481</td>
<td></td>
<td>RO</td>
</tr>
<tr>
<td>3 Silencer</td>
<td>608-RKW</td>
<td></td>
<td>RO</td>
</tr>
</tbody>
</table>

| Set: 13 – Lab |

| Doors: 118A, 118B |

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Hinge</td>
<td>T4A3786 4-1/2&quot; x 4-1/2&quot;</td>
<td></td>
<td>US26D</td>
</tr>
<tr>
<td>1 Security Classroom Exit Device</td>
<td>ED5202 x N955ET x D1 keyway x M110 x CMK x CMK x MK</td>
<td></td>
<td>RU</td>
</tr>
<tr>
<td>1 Closer</td>
<td>DC6210 A3</td>
<td></td>
<td>RU</td>
</tr>
<tr>
<td>1 Kickplate</td>
<td>K1050 10&quot; x 2&quot; LDW 4BE CSK</td>
<td></td>
<td>RO</td>
</tr>
<tr>
<td>1 Door Stop &amp; Holder (Install at top of door)</td>
<td>494R US26D</td>
<td></td>
<td>RO</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>151 A x DOW x MS &amp; ES25</td>
<td></td>
<td>PE</td>
</tr>
<tr>
<td>1 Gasketing (Set)</td>
<td>S88 BL x DOW x DOH</td>
<td></td>
<td>PE</td>
</tr>
<tr>
<td>1 Automatic Door Bottom</td>
<td>434 APKL x DOW</td>
<td></td>
<td>PE</td>
</tr>
</tbody>
</table>

| Set: 14 – Custodian |

| Doors: 118C |

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Hinge</td>
<td>TA2714 4-1/2&quot; x 4-1/2&quot;</td>
<td></td>
<td>US26D</td>
</tr>
<tr>
<td>1 Storeroom Lockset</td>
<td>ML2057 NSA x D1 keyway x CMK x CMK</td>
<td></td>
<td>RU</td>
</tr>
<tr>
<td>1 Kickplate</td>
<td>K1050 10&quot; x 2&quot; LDW 4BE CSK</td>
<td></td>
<td>RO</td>
</tr>
<tr>
<td>1 Overhead Stop</td>
<td>9-X36 x 90 deg</td>
<td></td>
<td>RF</td>
</tr>
<tr>
<td>3 Silencer</td>
<td>608-RKW</td>
<td></td>
<td>RO</td>
</tr>
</tbody>
</table>

| Set: 15 – Gate |

| Doors: 119A |

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Cylinder (Furnish one per leaf)</td>
<td>&quot;As required&quot; x temporary core x CMK</td>
<td>626</td>
<td>RU</td>
</tr>
<tr>
<td>2 Permanent Core</td>
<td>CR8027 x MK</td>
<td>626</td>
<td>RU</td>
</tr>
</tbody>
</table>

Balance of hardware furnished by gate manufacturer

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section includes glazing products, including those specified in other Sections where glazing requirements are specified by reference to this Section as required by Contract Documents.

1.2 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

D. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
   a. Design Wind Loads: Determine design wind loads applicable to project from basic wind speed indicated in miles per hour at 33 feet above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Contract Drawings.
   b. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.
      1) For monolithic-glass lites heat treated to resist wind loads.
      2) For insulating glass.
C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated including performance data for glass.

B. Samples: For the following products, in the form of 12-inch-square Samples for glass.
   1. Each color of float glass.
   2. Wired glass.
   3. Insulating glass for each designation indicated.

C. Glazing Schedule: Use same designations indicated on Contract Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

D. Generally retain paragraph and subparagraph below unless types of glass selected do not require labeling by authorities having jurisdiction or if certification is required as well as labels. See Evaluations.

E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
   1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this project; whose work has resulted in glass installations with a record of successful in-service performance.

B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear float and insulating glass.

C. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.
D. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

E. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, for wired glass, ANSI Z97.1.
   1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
   2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

F. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA Publications: GANA's "Glazing Manual."

G. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
   1. Insulating Glass Certification Council.

H. Conform to applicable requirements of Section 01351, Sustainable Project Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.8 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to the Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions"
Article, f.o.b. the nearest shipping point to Project Site, within specified warranty period indicated below.

1. Warranty Period: 5 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to the Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project Site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, manufacturers specified.

2.2 GLASS PRODUCTS

A. Float Glass (Type G-1): ASTM C1036, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select; 1/4 inch thick minimum.


C. Wire Glass (Type G-3): Clear, polished both sides, square mesh of woven stainless steel wire of 2 inch grid size; 1/4 inch thick. Conform to ANSI Z97.1.

D. Safety Glass (Type G-4): Clear; fully tempered; conforming to ANSI A97.1 and CPSC 96 CFR (1201); 3/8 inch thick minimum.

E. Tinted Glass (Type G-5): Float type, tempered, light reducing tinted color; light transmittance of 70 percent, 3/8 inch thick minimum. Color as selected by Owner/Architect.

F. Insulating-Glass Units, General (Type G-6 and G-7): Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.

1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.

2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.

3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.

4. Sealing System: Dual seal, with primary and secondary sealants as follows:
   a. Manufacturer's standard sealants.
5. Spacer Specifications: Manufacturer's standard spacer material and construction.

G. Port Window Glass (Type G-9): 10 mm optical low iron water white float glass with 6x magnetron sputtered anti-reflective coatings applied both sides (not sprayed on) 98% light transmission as manufactured by Flabeg Technical Glass Corp, Church + Bridge Streets, P.O. Box 71, Naugatuck, CT 06770; Phone: 1-203-729-5227.

2.3 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
   2. EPDM, ASTM C 864.
   4. Thermoplastic polyolefin rubber, ASTM C 1115.
   5. Any material indicated above.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
   1. Neoprene.
   2. EPDM.
   4. Thermoplastic polyolefin rubber.
   5. Any material indicated above.

C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.4 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
   1. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.5 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.6 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.

C. Grind smooth and polish exposed glass edges and corners.

2.7 MONOLITHIC FLOAT-GLASS UNITS

A. Uncoated Clear Float-Glass Units: Class 1 (clear) annealed or Kind HS (heat-strengthened) float glass where heat strengthening is required to resist thermal stresses induced by differential shading of individual glass lites and to comply with system performance requirements.

1. Thickness: 1/4 inch thick minimum.

2.8 MONOLITHIC WIRED-GLASS UNITS

A. Polished Wired-Glass Units: Form 1 (wired glass, polished both sides), Quality-Q6, Mesh 1 (Diamond), 1/4 inch thick.

1. Available Manufacturers:
   a. Asahi/AMA Glass Corp.; affiliated with AFG Industries, Inc.
   b. Central Glass Co., Ltd.; distributed by Northwestern Industries Inc.
   c. Pilkington Sales (North America) Ltd.
   d. Substitutions: Or approved equal.

2.9 INSULATING-GLASS UNITS

A. Tinted Insulating-Glass Units (G-6 & G-7):

1. Acceptable Manufactures:
   a. PPG – Solarban 70XL – Clear (Basis of Design).
   b. Oldcastle.
   c. Guardian.
   d. Pilkington.
   e. Substitutions: In accordance with Section 01 60 00.

2. Overall Unit Thickness and Thickness of Each Lite: 1/4 inch minimum individual glass lite thickness with an overall unit thickness of 1 inch.

3. Interspace Content: Argon.

4. Outdoor Lite: Class 1 float glass.

5. Indoor Lite: Class 1 (clear) float glass.
   a. Kind HS (heat strengthened).

6. Low-E Coating: Pyrolytic or sputtered on second or third surface.

7. Visible Light Transmittance: 64 percent minimum.

8. Summer Daytime U-Factor: 0.26 maximum.

9. Solar Heat Gain Coefficient: 0.27 maximum.

10. Shading Coefficient: 0.327 minimum.

B. Insulated “Spandrel” Glass Unit (Type G-8) similar to Type S G-6 and G-7 with outer lute of 1/4 inch spandrel glazing to match color of specified glazing, 1 inch.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep system.
   3. Minimum required face or edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Contract Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project Site and legally dispose of off Project Site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
D. Install gaskets so they protrude past face of glazing stops.

3.6 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.7 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION
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<td>Quartz Tile</td>
<td>FLOOR - Mosaic Collection</td>
<td>Color A - Storage 110, Storage Mezzanine, Color B - Vestibules, Gathering/Display</td>
<td>UpoFloor</td>
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<td>J &amp; J Invision</td>
<td>Tempo Style 2023, 12' width</td>
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<td>Stage, Auditorium Elevated ADA Walkway</td>
<td>Industrial Plywood - (TBD) Paint (PPG)</td>
<td>Tempered Plyron Solid Core (1/2&quot; Thick) Paint (Break-Through)</td>
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<td>Matte</td>
<td>X735 Matte Almond</td>
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<td>Wall Panel System</td>
<td>Auditorium</td>
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<td>InPro Corp.</td>
<td>Palladium 3D Trim System</td>
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Palladium Rigid Sheet Woodlands w/1 1/2" wide Tape On Corner Guards - TBD
## COLOR SCHEDULE

**WCPS Boonsboro High Auditorium Renovations**
_BFM # 16060/1CA8_  
_December 2, 2019_

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<td>Porcelain Walltile</td>
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### CEILINGS

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PART 1 GENERAL

1.1 SECTION INCLUDES

A. Formed metal stud framing at interior locations.
B. Framing accessories.

1.2 RELATED SECTIONS

A. Section 05 40 00 - Cold Formed Metal Framing: Exterior wall and roof framing.
B. Section 06 10 00 - Rough Carpentry: Framing, sheathing and rough wood blocking.
C. Section 07 21 00 – Thermal Insulation.
D. Section 07 71 00 - Manufactured Roof Specialties
E. Section 07 90 00 - Joint Sealers.
F. Section 09 26 00 - Gypsum Board Systems: Metal studs for partitioning.

1.3 REFERENCES

B. ASTM A653/A653M-08 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
C. ASTM A924 - Steel Sheet, Cold-Rolled, Electrolytic Zinc-Coated.
E. ASTM C645 - Non-Load (Axial) Bearing Steel Studs, Runners (Track) and Rigid Furring Channels for Screw Application of Gypsum Board.
F. ASTM C754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wallboard, Backing Board, or Water-Resistant Backing Board.
G. GA 203 - Installation of Screw-Type Steel Framing Members to Receive Gypsum Board.
H. Metal Framing Manufacturers Association (MFMA) - Guidelines for the Use of Metal Framing.
I. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.

1.4 SYSTEM DESCRIPTION

A. Metal stud framing system for interior walls, with batt type acoustic insulation specified in Section 07 21 00, and interior gypsum board specified in Section 09 26 00.
B. Design and size components to withstand dead and live loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with code.
C. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

1.5 SUBMITTALS
A. Submit under provisions of Section 01 33 00.
B. Shop Drawings: Indicate component details, anchorage to structure, type and location of fasteners, and accessories or items required of other related work.
C. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement to framing connections.
D. Product Data: Provide data describing standard framing member materials and finish, product criteria, load charts, and limitations.
E. Manufacturer’s Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.6 QUALITY ASSURANCE
A. Perform Work in accordance with GA 203 and ASTM C754.
B. Maintain one copy of each document on site.

1.7 QUALIFICATIONS
A. Installer: Company specializing in performing the work of this section with minimum five years documented experience.

1.8 COORDINATION
A. Coordinate work under provisions of Section 01 31 00.
B. Coordinate with the placement of components within the stud framing system, specified in Section 06 11 40 and Divisions 22, 23, and 26.

PART 2 PRODUCTS
2.1 STUD FRAMING MATERIALS
A. Studs: Meeting requirements of ASTM C645; C-Channel, roll-formed from hot-dipped galvanized steel; complying with ASTM A1003 and ASTM A653 G40 or equivalent corrosion resistant coating, depth as detailed:
1. Subject to compliance with requirements, provide Dietrich UltraSTEEL Framing (20 gauge equivalent).
a. Clark Dietrich Prostud Fire rated partitions to be installed in accordance with UL V450, V438, or V419.
2. Thickness: Interior - 20 gauge.
B. Runners: Of same material and thickness as studs.
C. Deflection Track Slotted: Manufacturer’s single, deep-leg, U-shaped steel track: punched with vertical slots in both legs. Steel Sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection from structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
   1. Subject to compliance with requirements, provide Clark Dietrich Maxtrak or Blazeframe Slotted Deflection Track.

D. Channel Bridging or Bracing: U-Channel Assembly; Base metal thickness of .0538 inch and minimum ½ inch wide flanges.
   1. Subject to compliance with requirements, provide Dietrich Metal Framing: Spazzer 9200 Bridging and Bracing Bar.
   2. U-Channel Assembly: 1 ½ inches
      a. Clark Dietrich Metal Framing; Easy Clip U-Series Clip Angle or equivalent.

E. Furring and Bracing Members: Of same material as studs; thickness to suit purpose.


G. Sheet Metal Backing: 18 gage galvanized steel for reinforcement.


I. Touch-Up Primer for Galvanized Surfaces: SSPC - Paint 20 Type I Inorganic zinc rich.

2.2 FABRICATION

A. Fabricate assemblies to sizes and profiles required; with framing members fitted, reinforced, and braced to suit design requirements.

B. Fit and assemble in largest practical sections for delivery to site, ready for installation.

2.3 FINISHES

A. Studs and Track: Galvanize to G40 (minimum) coating class.

B. Headers: Galvanize to G90 coating class.

C. Accessories: Same finish as framing members. ASTM A123, hot dip galvanized to 1.25 oz/sq ft.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions under provisions of Section 01 31 00.

B. Verify that conditions are ready to receive work.

C. Verify that rough-in utilities are in proper location.

3.2 ERECTION

A. Installation Standard: Comply with ASTM C 754

B. Align and secure top and bottom runners at 24 inches oc.
C. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
D. Install studs vertically at 16 inches oc.
E. Align stud web openings horizontally.
F. Secure studs to tracks using crimping method. Do not weld.
G. Stud splicing not permissible.
H. Fabricate corners using a minimum of three studs.
I. Double stud at wall openings, door and window jambs, not more than 2 inches (50 mm) from each side of openings.
J. Brace stud framing system rigid.
K. Coordinate erection of studs with requirements of door frames, window frames, and markerboards, chalkboards and tackboards; install supports and attachments.
L. Coordinate installation of wood bucks, anchors, and wood blocking with electrical and mechanical work to be placed within or behind stud framing.
M. Blocking: Secure wood blocking to studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and chalkboards, markerboards and tackboards.
N. Refer to Drawings for indication of partitions extending to finished ceiling only and for partitions extending through the ceiling to the structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.
O. Coordinate placement of insulation in stud spaces made inaccessible after stud framing erection.

END OF SECTION
PART 1   GENERAL

1.1 SUMMARY
   A. This Section includes the following:
      1. Interior gypsum board.
      2. Tile backing panels.

1.2 SUBMITTALS
   A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE
   A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide
      materials and construction identical to those tested in assembly indicated
      according to ASTM E 119 by an independent testing agency.
   B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction
      identical to those tested in assembly indicated according to ASTM E 90 and classified
      according to ASTM E 413 by an independent testing agency.

1.4 STORAGE AND HANDLING
   A. Store materials inside under cover and keep them dry and protected against
      damage from weather, condensation, direct sunlight, construction traffic, and
      other causes. Stack panels flat to prevent sagging.

1.5 PROJECT CONDITIONS
   A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum
      board manufacturer's written recommendations, whichever are more stringent.
   B. Do not install interior products until installation areas are enclosed and
      conditioned.
   C. Do not install panels that are wet, those that are moisture damaged, and those that
      are mold damaged.
      1. Indications that panels are wet or moisture damaged include, but are not
         limited to, discoloration, sagging, or irregular shape.
      2. Indications that panels are mold damaged include, but are not limited to, fuzzy or
         splotchy surface contamination and discoloration.

PART 2   PRODUCTS

2.1 PANELS, GENERAL
   A. Size: Provide in maximum lengths and widths available that will minimize joints
      in each area and that correspond with support system indicated.
2.2 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. G-P Gypsum.
      b. Lafarge North America Inc.
      c. National Gypsum Company.
      d. USG Corporation.

B. Regular Type:
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.

C. Type X:
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.

D. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.

E. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board.
   1. Core: Type X.
   2. Long Edges: Tapered.

F. High-Impact Type: Manufactured with Type X core, plastic film laminated to back side for greater resistance to through-penetration (impact resistance).
   1. Core: 5/8 inch thick.
   2. Plastic-Film Thickness: 0.010 inch.

G. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
   1. Core: 5/8 inch, Type X.
   2. Long Edges: Tapered.

2.3 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board:
   1. Complying with ASTM C 1178/C 1178M.
      a. Product: Subject to compliance with requirements, provide "DensShield Tile Guard" by G-P Gypsum.
   2. Complying with ASTM C1177/C 1177M.
      a. Product: Subject to compliance with requirements, provide "DensArmor Plus Interior Guard" by G-P Gypsum.
   3. Core: 5/8 inch, Type X.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:
   a. Cornerbead.
   b. Bullnose bead.
   c. LC-Bead: J-shaped; exposed long flange receives joint compound.
   d. L-Bead: L-shaped; exposed long flange receives joint compound.
   e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
   f. Expansion (control) joint.
   g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Fry Reglet Corp.
      b. Gordon, Inc.
      c. Pittcon Industries.
   2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
   3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper.
   2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
   3. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
   3. Fill Coat: For second coat, use drying-type, all-purpose compound.
   4. Finish Coat: For third coat, use drying-type, all-purpose compound.
   5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:
   1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
   2. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
   1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
   2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Acoustical Sealant: As specified in Division 7 Section "Joint Sealants."

E. Thermal Insulation: As specified in Division 7 Section "Building Insulation."

PART 3  EXECUTION

3.1  EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2  APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
   a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
   b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multilayer Application:
1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

C. Curved Surfaces:
1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.
3.4 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
   1. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
   2. Fasten with corrosion-resistant screws.

3.5 APPLYING TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile and where indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.

B. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.6 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Professional for visual effect.

C. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners, unless otherwise indicated.
   2. U-Bead: Use at exposed panel edges.
   3. Curved-Edge Cornerbead: Use at curved openings.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.7 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Provide the following level of finish in accordance with the Gypsum Construction Handbook – Latest Edition.
   1. Level of Finish Schedule:
      a. Level 0 – Temporary Construction.
      b. Level 1 – Plenum areas above ceilings or areas not exposed to view.
      c. Level 2 – WR Gypsum backing board being used for tile substrate.
      d. Level 3 – Gypsum board scheduled to relieve heavy textured finishes or commercial grade wall coverings.
e. Level 4 – Gypsum board scheduled to receive light textured finishes or residential grade wall coverings.
f. Level 5 – All gypsum board scheduled to receive paint finish.

E. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

3.8 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section includes porcelain floor tile, base, and wall tile; thin-set application method; cementitious backer board as tile substrate; and thresholds at door openings.

B. Related Sections:
1. Section 03 37 00 - Concrete Curing.
2. Section 07 90 00 - Joint Sealers.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A108.1 - Installation of Ceramic Tile, A collection.
2. ANSI A108.1A - Specifications for Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar.
5. ANSI A108.4 - Specifications for Ceramic Tile Installed with Organic Adhesives or Water-Cleanable Tile Setting Epoxy Adhesive.
6. ANSI A108.5 - Specifications for Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
7. ANSI A108.6 - Specifications for Ceramic Tile Installed with Chemical-Resistant, Water-Cleanable Tile-Setting and -Grouting Epoxy.
8. ANSI A108.7 - Specifications for Electrically Conductive Ceramic Tile Installed with Conductive Dry-Set Portland Cement Mortar.
9. ANSI A108.8 - Specifications for Ceramic Tile Installed with Chemical-Resistant Furan Mortar and Grout.
10. ANSI A108.9 - Specifications for Ceramic Tile Installed with Modified Epoxy Emulsion Mortar/Grout.
13. ANSI A118.3 - Chemical-Resistant, Water-Cleanable, Tile-Setting and -Grouting Epoxy and Water-Cleanable Tile-Setting Epoxy Adhesive.
14. ANSI A118.4 - Latex-Portland Cement Mortar.
15. ANSI A118.5 - Chemical-Resistant Furan Mortar and Grout.
16. ANSI A118.6 - Ceramic Tile Grouts.
17. ANSI A118.8 - Modified Epoxy Emulsion Mortar/Grout.
18. ANSI A118.9 - Test Methods and Specifications for Cementitious Backer Units.
20. ANSI A137.1 - Ceramic Tile.
B. ASTM International:

C. Tile Council of America:

1.3 SUBMITTALs

A. Section 01 33 00 - Submittal Procedures.

B. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, and setting details.

C. Product Data: Submit instructions for using grouts and adhesives.

D. Samples: Submit mounted tile and grout on two plywood panels, 12 x 12 inch in size illustrating pattern, color variations, and grout joint size variations.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALs

A. Section 01 73 00 – Execution Requirements.

B. Operation and Maintenance Data: Submit recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with TCA Handbook and ANSI A108 Series/A118 Series.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience and approved by tile manufacturer.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 31 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum two weeks prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements: Product storage and handling requirements.

B. Protect adhesives and grouts from freezing or overheating.
1.9 ENVIRONMENTAL REQUIREMENTS
   A. Section 01 60 00 – Product Requirements.
   B. Do not install adhesives and grouts in unventilated environment.
   C. Maintain ambient and subrate temperature of 50 degrees F during installation of mortar materials.

1.10 EXTRA MATERIALS
   A. Section 01 73 00 – Execution Requirements.
   B. Supply 20 sq ft of each size, color, and surface finish of tile specified.

PART 2 PRODUCTS

2.1 TILE
   A. Manufacturers:
      3. Substitutions: Section 01 60 00 - Product Requirements.

2.2 COMPONENTS
   A. Floor Tile – Toilet Rooms
      1. Porcelain Floor Tile: equal to Daltil Keystones; ANSI A137.1, conforming to the following:
         a. Moisture Absorption: 0 to 0.5%
         b. Size: 2” x 1 2” x 1/4”
         c. Shape: Square
         d. Edge: Cushioned
         e. Surface Finish: Unpolished
         f. Color: As selected by Architect.

   B. Wall Tile – Lobby
      1. Mosaic Porcelain Tile: Equal to Daltil Formula; ANSI A137.1, conforming to the following:
         a. Moisture Absorption: 0 to 0.5%
         b. Size: 12” x 24” x 3/8”
         c. Shape: Rectangular
         d. Edge: Cushioned
         e. Surface Finish: Polished
         f. Color: As selected by Architect.

   C. Wall Tile and Base Tile:
      1. Ceramic Wall Tile: Equal to Daltil Semi-Gloss Matte: ANSI A137.1, conforming to the following:
         a. Moisture Absorption: 0 to 20.0 %
         b. Size: 6” x 6” x 5/16”
         c. Shape: Square
         d. Edge: Cushioned
e. Surface Finish: Matte
f. Color: As selected by Architect.
g. Base: Wall Bullnose S-4669, 6” x 6”

2.3 ACCESSORIES

A. Adhesive Materials:

B. Grout Materials:
   1. Polymer Modified Tile Grout: ANSI A118.7; color as selected

C. Anti-Fracture Membrane at Floors: Equal to Schluter Ditra.

D. Thresholds: Marble type, color as selected, honed finish, provide opening length by full width of wall or frame opening, beveled both sides, radiused edges from bevel to vertical face.

E. Tile Floor Edging: equal to Schluter Systems.

2.4 WATERPROOFING SYSTEMS

A. Floor and Wall Waterproofing Membrane
   1. Laticrete Hydro Ban
      a. Single component self curing liquid rubber polymer that forms a thin, flexible, seamless, load baring and breathable waterproofing/crack isolation membrane.

2.5 SETTING AND GROUTING MATERIALS

   1. For wall applications, provide nonsagging mortar that complies with Paragraph C-4.6.1 in addition to the other requirements in ANSI A118.1.

B. Latex-Portland Cement Mortar (Thin Set) Tile under 15”): ANSI A118.4, consisting of the following:
   1. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which only water must be added at Project site.
   2. Prepackaged dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive.
      a. For wall applications, provide nonsagging mortar that complies with Paragraph F4.6.1 in addition to the other requirements in ANSI A118.4.

C. Polymer-Enriched Mortar Medium Bed and Thinset (Tiles over 15”): ANSI A118.4 and A118.11 consisting of the following: (Equal to Mapei Ultraflex LFT)
   1. Polymer-enriched for high performance and deformability.
   2. Nonsag formula for large-format tile and stone in wall applications.
   3. Nonslump for large-format tile and stone in floor applications. Can be used as a medium bed up to ¼” thick.
   4. Smooth and creamy consistency makes it easy to apply.
5. Low-Dust Technology reduces dust by 90%, resulting in a cleaner and healthier environment.

PART 3 EXECUTION

3.1 EXAMINATION
A. Section 01 31 00 - Administrative Requirements: Coordination and project conditions.
B. Verify surfaces are ready to receive work.

3.2 PREPARATION
A. Protect surrounding work from damage.
B. Vacuum clean surfaces and damp clean.
C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
D. Install cementitious backer board. Tape joints and corners, cover with skim coat of dry-set mortar to feather edge.
E. Prepare substrate surfaces for adhesive installation.

3.3 WATERPROOFING, UNCOUPLING MEMBRANE
A. Clean and repair concrete slab if needed.
B. Install Schluter Ditra Anti-Fracture Membrane according to manufacturer requirements.

3.4 INSTALLATION
A. Install tile, thresholds, and grout in accordance with applicable requirements of ANSI A108.1 through A108.10, and TCA Handbook recommendations.
B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
C. Place thresholds edge strips at exposed tile edges.
D. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor, base and wall joints.
E. Place tile with joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
F. Form internal angles square and external angles bullnosed.
G. Sound tile after setting. Replace hollow sounding units.
H. Keep expansion control joints free of adhesive or grout. Apply sealant to joints.
I. Allow tile to set for a minimum of 48 hours prior to grouting.
J. Grout tile joints. Use standard grout unless otherwise indicated.

K. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

L. Installation - Floors - Thin-Set Methods:
   1. Over interior concrete substrates, install in accordance with TCA Handbook Method F113, latex-portland cement bond coat with polymer modified unsanded tile grout [A118.7 (4, 9)].
      a. Where waterproofing membrane is indicated, install in accordance with TCA Handbook Method F122, with latex-portland cement grout.

3.5 CLEANING
   A. Section 01 73 00 – Execution Requirements.
   B. Clean tile and grout surfaces.

3.6 PROTECTION OF INSTALLED CONSTRUCTION
   A. Section 01 60 00 – Product Requirements: Protecting installed construction.
   B. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION
PART 1  GENERAL

1.1  SECTION INCLUDES
   A. Suspended metal grid ceiling system and perimeter trim.
   B. Acoustical tile.
   C. Non-fire rated assembly.

1.2  RELATED SECTIONS
   A. Section 21 13 12 - Fire Suppression Sprinkler System: Sprinkler heads in ceiling system.
   B. Section 23 30 00 – HVAC Air Distribution: Air diffusion devices in ceiling system.
   C. Section 26 50 00 - Lighting: Light fixtures in ceiling system.
   D. Section 28 31 00 – Fire Detection and Alarm: Fire alarm components in ceiling system.

1.3  REFERENCES
   A. ASTM C635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
   B. ASTM C636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
   E. ASTM E1264 - Classification of Acoustical Ceiling Products.
   F. Ceilings and Interior Systems Contractors Association (CISCA) - Acoustical Ceilings: Use and Practice.

1.4  SYSTEM DESCRIPTION
   A. Suspension system to rigidly secure acoustical ceiling system including integral mechanical and electrical components with maximum deflection of 1/360.

1.5  SUBMITTALS
   A. Submit under provisions of Section 01 33 00.
   B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to system.
C. Product Data: Provide data on metal grid system components, and acoustical units.

D. Samples: Submit two samples 6 x 6 inch in size illustrating material and finish of acoustical units.

E. Samples: Submit two samples each, 12 inches long, of suspension system main runner, cross runner, and edge trim.

F. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.6 QUALIFICATIONS

A. Grid Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable code for combustibility requirements for materials.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.9 SEQUENCING

A. Sequence work under the provisions of Section 01 31 00.

B. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

C. Install acoustical units after interior wet work is dry.

1.10 EXTRA MATERIALS

A. Furnish under provisions of Section 01 73 00.

B. Provide 5 percent of total acoustical unit area of each type of extra tile to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS - SUSPENSION SYSTEM

A. Specified Manufacturer: Armstrong.

B. Other Acceptable Manufacturers:
   1. Chicago.
   2. Donn.

C. Substitutions: Under provisions of Section 01 60 00.
2.2 SUSPENSION SYSTEM MATERIALS

A. Non-fire Rated Grid: ASTM C635, intermediate duty; exposed T paired access T; components die cut and interlocking.
   1. Use Armstrong's Prelude w/Type 1 and 2 ceilings.

B. Grid Materials: Cold rolled steel.
   1. Prelude Plus 15/16 inch: Galvanized and coated steel with aluminum cap as required.

C. Exposed Grid Surface Width: 15/16 inch.

D. Grid Finish: color as selected.

E. Accessories: Stabilizer bars clips splices edge moldings and hold down clips required for suspended grid system.

F. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.

2.3 MANUFACTURERS - ACOUSTICAL UNITS

A. Specified Manufacturer: Armstrong

B. Other Acceptable Manufacturers
   1. USG
   2. Celotex.

C. Substitutions: Under provisions of Section 01 60 00.

2.4 ACOUSTICAL UNIT MATERIALS

A. Acoustical Panels: (C1) Type 1 - Armstrong Utima – 1941 conforming to the following:
   1. Size: 24 x 24 inches
   2. Thickness: 7/8 inches
   3. Composition: Mineral
   4. Density: 1.25 lb/sq ft
   5. Light Reflectance: 87 percent
   6. NRC Range: .80
   7. Fire Spread: 0-25 per ASTM E84
   8. Edge: Beveled Tegular
   9. Surface Color: White
   10. Surface Finish: Factory applied latex paint.

B. Acoustical Panels: (C2) Type 2 - Armstrong's Pebble - 2989 conforming to the following:
   1. Size: 24 x 48 inches
   2. Thickness: 1 inch
   3. Composition: Fiberglass with vinyl facing, perforated
   4. Density: .31 lb/sq ft
   5. Light Reflectance: .89 percent
   6. NRC Range: .80
   7. Flame Spread: 0-25 per ASTM E84
   8. Edge: Square
   9. Surface Color: White
   10. Surface Finish: Scrubbable vinyl film facing
C. Linear Wood Ceiling (C3) – Armstrong’s Metal Works Linear Effects Wood Look 5492 (Color: TBD) and 5493 (Color: TBD) conforming to the following:
   1. Size: 96 x 4 inches, 96 x 8 inches
   2. Thickness: 5/8 inches
   3. Composition: Electrogalvanized steel
   4. Density: 1.61 lb/sq ft
   5. Light Reflectance: .61 percent
   6. NRC Range: .70
   7. Fire Spread: 0-25 per ASTM E84
   8. Edge: Square with extended flange
   9. Surface Color: TBD
   10. Surface Finish: Powder coated

D. Acoustical Panels (C7) Type 3 – Armstrong’s School Zone Fine Fissured 1713 conforming to the following:
   1. Size: 2 ft x 2 ft
   2. Thickness: 3/4 inches
   3. Composition: Wet formed mineral fiber
   4. Density: 1.31 lb/sq ft
   5. Light Reflectance: .85 percent
   6. NRC Range: .70
   7. Fire Spread: 0-25 per ASTM E84
   8. Edge: Square Lay-IN
   9. Surface Color: Tech Black
   10. Surface Finish: Factory applied latex paint

2.5 ACCESSORIES
   A. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION
3.1 EXAMINATION
   A. Verify site conditions under provisions of Section 01 31 00.
   B. Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM
   A. Install suspension system in accordance with manufacturer's instructions and as supplemented in this section.
   B. Install system capable of supporting imposed loads to a deflection of 1/360 maximum.
   C. Locate system on room axis according to reflected plan.
   D. Install after major above ceiling work is complete. Coordinate the location of hangers with other work.
   E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
   F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.

H. Do not eccentrically load system or produce rotation of runners.

I. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.

J. Form expansion joints where required. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.

3.3 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Lay directional patterned units one way with pattern parallel to shortest room axis in basket weave pattern. Fit border trim neatly against abutting surfaces.

D. Install units after above ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp and dents.

F. Cut tile to fit irregular grid and perimeter edge trim. Field rabbet tile edge. Double cut and field paint exposed edges of tegular units.

G. Where bullnose concrete block corners round obstructions occur, provide preformed closers to match edge molding.

H. Install hold-down clips to retain panels tight to grid system.

3.4 ERECTION TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quartz tile.
B. Resilient base.

1.2 RELATED SECTIONS

A. Section 01 15 00 - Alternates.
B. Section 03 30 00 - Cast-in-Place Concrete: Floor substrate surface.

1.3 REFERENCES

A. ASTM E84 - Surface Burning Characteristics of Building Materials.
B. FS L-F-1641 - Floor Covering, Translucent or Transparent Vinyl Surface, with Backing.
C. FS L-F-475 - Floor Covering, Vinyl Surface (Tile and Roll), with Backing.
D. FS RR-T-650 - Treads, Metallic and Non-metallic, Non-skid.

1.4 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame/ fuel/smoke rating requirements of in accordance with ASTM E84.

1.5 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01 33 00.
B. Provide product data on specified products, describing physical and performance characteristics, sizes, patterns and colors available.
C. Submit samples under provisions of Section 01 33 00.
D. Submit two samples 3 x 3 inches in size, illustrating color and pattern for each floor material specified.
E. Submit two 3 inch long samples of base material for each color specified.
F. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.6 OPERATION AND MAINTENANCE DATA
A. Submit cleaning and maintenance data under provisions of Section 01 73 00.

B. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Store materials for three days prior to installation in area of installation to achieve temperature stability.

B. Maintain ambient temperature required by adhesive manufacturer three days prior to, during, and 24 hours after installation of materials.

1.8 EXTRA MATERIALS

A. Provide 100 sq ft of each color of selected flooring and 1 coil of each base color of each material specified under provisions of Section 01 73 00.

PART 2 PRODUCTS

2.1 MANUFACTURERS – QUARTZ TILE FLOORING

A. UpoFloor. (Basis of Design)

B. Substitutions: Under provisions of Section 01 60 00.

2.2 QUARTZ FLOORING MATERIALS

A. Quartz Tile (F1): Equal to UpoFloor Quartz Mosaic Collections, 24” x 24”, 2.0 mm, ASTM F 1066. Color selected from standards by Architect.

2.3 ACCEPTABLE MANUFACTURERS - BASE MATERIALS

A. Flexco.

B. Johnsonite.

C. Mercer.

D. Roppe

E. Substitutions: Under provisions of Section 01 60 00.

2.4 BASE MATERIALS

A. Base: (B1) FS SS-W-40, extruded rubber; 4 inch high; 1/8 inch thick; coiled stock, (120 lineal feet per coil); top set coved. Corners field fabricated with minimum 12 inch returns.

B. Base Accessories: Premolded end stops of same material, size, and color as base.
2.6 ACCESSORIES
   A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
   B. Primers and Adhesives: types recommended by flooring manufacturer. Adhesive shall be equal to Armstrong's S-89 or S-90 Resilient Tile Adhesive.
   C. Edge Strips: Flooring material.

PART 3 EXECUTION

3.1 EXAMINATION
   A. Verify that surfaces are smooth and flat with maximum variation of 1/8 inch in 10 ft and are ready to receive Work.
   B. Verify concrete floors are dry to a maximum moisture content of 7 percent, and exhibit negative alkalinity, carbonization, or dusting.
   C. Beginning of installation means acceptance of substrate and site conditions.

3.2 PREPARATION
   A. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.
   B. Apply, trowel, and float filler to leave a smooth, flat, hard surface.
   C. Prohibit traffic from area until filler is cured.
   D. Vacuum clean substrate.
   E. Apply primer to surfaces.

3.3 INSTALLATION - TILE MATERIAL
   A. Install in accordance with manufacturers' instructions.
   B. Mix tile from container to ensure shade variations are consistent.
   C. Spread only enough adhesive to permit installation of materials before initial set.
   D. Set flooring in place; press with heavy roller to attain full adhesion.
   E. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile patterns.
   F. Install tile to square grid pattern with all joints aligned and with pattern grain parallel for all units and parallel to width of room. Allow minimum 1/2 full size tile width at room or area perimeter.
G. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.

H. Install edge strips at unprotected or exposed edges, and where flooring terminates.

I. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

J. Install flooring in pan type floor access covers. Maintain floor pattern.

K. Install flooring under movable partitions without interrupting floor pattern.

L. Install feature strips, and floor markings where indicated. Fit joints tightly.

3.4 INSTALLATION - BASE MATERIAL

A. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends use premolded units.

C. Install base on solid backing. Bond tight to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.5 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

3.6 CLEANING

A. Refer to Section 01 73 00- Execution Requirements.

B. Remove excess adhesive from floor, base, and wall surfaces without damage to finish.

C. Striping, sealing, wax, and polish of floor finishes by Owner.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section includes resinous matrix terrazzo floor and base; and divider strips.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete: Concrete subfloor.
   2. Section 07 90 00 - Joint Sealers: Joint between terrazzo base and wall surface.

1.2 REFERENCES

A. ASTM International:

B. National Terrazzo and Mosaic Association:
   1. NTMA - Terrazzo Specifications Guide.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate divider strip and control joint layout, flooring material transitions, color patterns, and details of adjacent components.

C. Product Data: Submit data for divider strips, control joint strips, and sealer.

D. Samples: Submit three (3) samples, 12 x 24 inch in size illustrating color, chip size and variation, chip gradation, matrix color and typical divider strip.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 73 00 - Execution Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit procedures for stain removal, stripping, and sealing.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with NTMA recommendations contained in "Terrazzo Information Guide".

B. Maintain one copy of document on site.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.
1.7 MOCKUP
A. Section 01 40 00 - Quality Requirements: Requirements for mockup.
B. Construct mockup, 2 x 4 feet including terrazzo flooring, base.
C. Locate where indicated on Drawings.
D. Incorporate accepted mockup as part of Work.
E. Remove mockup when directed by Architect/Engineer.

1.8 PRE-INSTALLATION MEETINGS
A. Section 01 31 00 - Administrative Requirements: Pre-installation meeting.
B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING
A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
B. Store resin materials in dry, secure area.
C. Maintain minimum temperature of 70 degrees F for five (5) days before installation. Tiles to be allowed to acclimate in space for 72 hours prior to installation.
D. Keep products away from fire or open flame.

1.10 ENVIRONMENTAL REQUIREMENTS
A. Section 01 60 00 - Product Requirements.
B. Do not install terrazzo when temperature is below 70 degrees F or above 90 degrees F.
C. Maintain temperature within specified range 24 hours before, during, and 48 hours after installation of flooring.

1.11 COORDINATION
A. Section 01 31 00 - Administrative Requirements: Requirements for coordination.
B. Coordinate placement of terrazzo divider strips with location of mechanical and electrical access covers, floor mat frames, and other items built in to terrazzo.

PART 2 PRODUCTS
2.1 RESINOUS MATRIX TERRAZZO
A. Manufacturers:
   1. Nurazzo Co. Model – Nurazzo Tile Recycled Marble
   2. Substitutions: Section 01 60 00 - Product Requirements
2.2 COMPONENTS
A. Floors: Epoxy resin binding matrix, RS801 Blue/Grey, 1/4 inch thick, Aggregate Size: 0, 70% recycled, 12” x 24”.
B. Base: Same type and thickness as floors.
C. Materials:
   1. Epoxy Matrix: Two component resin and epoxy hardener with mineral filler and color pigment, non-volatile, thermo-setting.
   2. Aggregate: Crushed natural stone, recycled glass, size as indicated on Drawings of standard gradation and uniform coloration.

2.3 ACCESSORIES
A. Divider Strips: 1/8 inch thick zinc exposed top strip, zinc coated steel concealed bottom strip, with anchoring features.
B. Control Joint Strips: 1/8 inch nominal width zinc exposed top strips, zinc coated steel concealed bottom strips, 1/8 inch wide neoprene filler strip between vertical strips, with anchoring features.
C. Strip Height: To suit thickness of terrazzo topping, with allowance for grinding.
D. Base Cap, Base Divider Strip, and Separator Strip: Match divider strips.

PART 3 EXECUTION
3.1 EXAMINATION
A. Section 01 31 00 - Administrative Requirements: Coordination and project conditions.
B. Verify substrate surfaces are ready to receive work.
C. Do not begin terrazzo work until concrete substrate has cured 28 days, minimum, and has dried to maximum moisture content of 12 percent.

3.2 PREPARATION
A. Clean substrate of foreign matter.

3.3 INSTALLATION
A. Joint Lines: Nurazzo tiles are to be installed with a grout joint, grout should be an epoxy grout and joint lines can be as small as 1/8” but no greater than 1/4”.
B. Expansion Joint Control Strips: Materials to be type suitable for the joint size and recommended by specifier or approved by the Nurazzo Tile manufacturer.
C. Install divider and control joint strips straight and level to locations indicated.
D. Install non-slip inserts in floors where indicated.
E. Install base divider and control joint strips to match floor pattern.
F. Install terminating cap strip at top of base; attach securely to wall substrate.

G. Thinset Method:
   1. Laticrete 254 Platinum as manufactured by Laticrete International. (1 Laticrete Park North Bethany, CT 06524-3423, Phone: 203-393-0010 ext. 235 or 800-243-4788 ext. 235)
   2. MAPEI: Thin-Bed Mortar: MAPEI, Ultraflex 3, MAPEI Kerabon Keralastic System. Rapid Setting; Granirapid System manufactured by MAPEI Corporation, 1144 East Newport Center Drive, Deerfield Beach, FL, 33442 (phone: 1-888-876-2734; Fax: 954-246-8805; Email: www.mapei.com).
   3. TEC Super Flex or TEC Isolight Mortar as manufactured by H.B. Fuller Construction Products Inc. (1105 S. Frontenac Road, Aurora, IL 60504, Phone: 1-800-552-6225)

3.4 ERECTION TOLERANCES
   A. Section 01 40 00 - Quality Requirements: Tolerances.
   B. Maximum Variation from Flat Surface: 1/8 inch in 10 feet.
   C. Maximum Variation from Level (Except Surfaces Sloping to Drain): 1/8 inch.

3.5 CLEANING
   A. Section 01 73 00 - Execution Requirements: Final cleaning.
   B. Scrub and clean terrazzo surfaces with cleaner. Let dry.
   C. Immediately after terrazzo has dried, apply sealer.
   D. Seal and polish surfaces according to manufacturer’s instructions.

3.6 PROTECTION OF INSTALLED CONSTRUCTION
   A. Section 01 73 00 - Execution Requirements: Protecting installed construction.
   B. Do not permit traffic over finished terrazzo surfaces.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES
   A. The Work of this Section includes all labor, materials, equipment and services necessary to complete the stage flooring over concrete sub-floor as shown on the drawings and/or specified herein, including but not necessarily limited to the following:
      1. Performance Floor Type A and B.

1.2 RELATED WORK
   A. Section 03 30 00 – Cast-In-Place Concrete.
   B. Section 03 34 60 – Concrete Floor Finishing.
   C. Section 03 37 00 – Concrete Curing.
   D. Section 06 11 40 – Wood Blocking and Curbing.
   E. Section 09 65 00 – Resilient Flooring.

1.3 SUBMITTALS
   A. Make submittals according to the submittal requirements of Section 01 33 00.
   B. Submittals: submitted in a timely manner allowing sufficient time for review and re-submittal.
   C. Submit shop drawings, product data sheets and samples for review for all work in this Section.
   D. Submit a 24" square sample for approval including all materials and parts of the floor construction and finishes above the concrete sub-floor.

1.4 REFERENCES
   C. Southern Pine Inspection Bureau 4709 Scenic Highway Pensacola FL 32504.
H. AITC: American Institute of Timber Construction.

1.5 QUALITY ASSURANCE
A. Bidder qualifications: specialty firm with not less than five years’ experience in installation of stage floors of the type specified.

1.6 MOISTURE CONTENT
A. Wood moisture content
1. 10% average, with moisture content in any one piece not less than 8% nor more than 12% at the time of delivery.
2. Test moisture content with electric meters calibrated and used as per ASTM D4444.

1.7 DELIVERY STORAGE AND HANDLING
A. Protect wood from moisture in shipment, storage and handling.
B. Do not deliver wood until damp trades such as concrete and plaster have been completed and cured to equilibrium.

1.8 PROJECT CONDITIONS AND ACCLIMATIZATION
A. Requirements for spaces used for wood storage and installation:
1. Enclosed.
2. Conditioned.
3. Humidity: same as when occupied.
4. Temperature between 65 degrees F. and 70 degrees F.
5. All maintained continuously before, during, and after installation.
B. Prior to installation store the wood in the space in which it will be installed, with the heating ventilating and air conditioning operating, for a period of two weeks or longer to allow the wood to acclimatize to the job conditions.

1.9 HIGH PERFORMANCE DESIGN REQUIREMENTS
A. Provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, “FSC Principles and Criteria for Forest Stewardship.”
B. Composite woods used in the Project shall contain no urea-formaldehyde.

1.10 WARRANTY
A. Warranty provisions of the contract apply to the work in this Section.
B. In addition, warrant the work in this Section for a period of two years including repair of shrinkage, creaks, warps, cracks, breaks, and separation from the substrate, except as resulting from standing water and unusual abuse.
C. Repair or replace work found to be defective during the warranty period promptly and at no cost to the owner.
D. Warranty period: 2 years.
1.11 THICKNESS OF ASSEMBLY
   A. Build the floor to fit into the slab recesses provided.
   B. Provide shims if necessary.
   C. Grind the sub-floor if necessary.

1.12 TOLERANCES
   A. Floor: level within 0.1000 inches overall and within 0.0625 inches in any 10-foot distance.

1.13 QUALITY
   A. Floor: free of surface blemishes, sanding marks, digs, gouges, irregularities in the finish and warp.
   B. Floor: free of marks from storage, handling, water, dirt, or other contamination.
   C. Visible fasteners: regular, neat, evenly spaced, plumb, set uniformly below the floor surface.
   D. Floor: silent, free of squeaks and all other noise.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - STAGE FLOORING
   A. Haywood Berk Flooring Co. 414 West Broadway, Suite 2S New York NY 10012, 212-242-0047
   B. Chambers and Sons Flooring 323 East King Street Malvern PA 19355; 610-647-0200
   C. No others.

2.2 PRODUCTS
   A. Plyron.
      1. Olympic Panel Products “Tempered Plyron Solid Core”.
      2. Width: 4’
      3. Length: 8’
      4. Thickness: 1/2”
      5. Tempered hardboard faces, front and back, 0.120 inches thick.
      6. Core: C grade Douglas fir inner plies as defined by PS-1 with no voids.
      8. Edge: Square, not tongue and groove.
      9. Pre-drilled and counter-bored in a jig for precise and uniform screw spacing.
      10. Before installation confirm that panels are cut at true right angles, not cut skewed. Correct skewed panels to true right angles before installation.

   B. Plywood.
1. APA Group 1.
2. Grade: APA C-C PLUGGED.
3. Exposure: APA EXPOSURE 1 – EXTERIOR.
4. Edge: square, not tongue and groove.

C. Sleepers and blocking.
   1. Species: Southern Yellow Pine
   2. Grade: plain sawn C&Btr.

D. Adhesive: PL 400 VOC construction adhesive; VOC limit of 50 g/L less water.

E. Fiberglass board – Unfaced, 2.25 pcf, thickness as indicated on drawings.
   1. Owens Corning Product CW225.
   2. CertainTeed CB-225.
   4. Knauff Insulation Board.

F. Joint filler at doors: Solid cork.


H. Sub-flooring screws: 2" Zinc Plated Carbon Steel Flat Phillips.

I. Stop blocks: EXT DFPA exposure 1, species 1 C-D plywood of the proper thickness.

J. Finish Paint: Equal to PPG Break-Through! Interior/Exterior Waterborne acrylic, Satin Finish Black. (Refer to Painting Spec 09 90-00, 3.5 Interior Paint Systems, I Stage Flooring)

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where the work in this Section is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

B. Concrete moisture.
   1. Prior to installing flooring, test concrete and concrete patches for moisture.
   2. Do not begin installation if floor contains excess moisture.
   3. Consult NOFMA technical service bulletins for concrete moisture testing techniques.

C. Starting installation indicates that the contractor for the work in this section accepts all conditions as suitable.

3.2 MORTISES AND OPENINGS FOR STAGE EQUIPMENT.

A. Provide mortises and framed openings in the stage floor to accommodate stage equipment.
3.3 STAGE FLOOR TYPE "A" INSTALLATION

A. Grind down and/or build up the subfloor slab with self-leveling underlayment concrete and/or shims to meet the finished floor tolerances specified in this Section.

B. Apply self-leveling underlayment concrete where needed to meet the finished floor tolerances specified in this Section using the manufacturer’s published instructions. Allow dry time.

C. Broom clean the sub-floor of dust, dirt, and construction debris before starting installation.

D. Install fiberglass board laid loose in continuous strips between the sleepers.

E. Lay sleepers on isolators and laser-level the floor. Shim as required. Sleeper direction: north/south.


G. Lay first layer of plywood over sleepers and fasten with adhesive and screws. Run panels perpendicular to sleepers. Stagger panels 48" in adjacent rows. Align end joints over sleepers. Leave 1/8" gap all around each sheet. Space screws on 6" centers at supported edges and 12" centers over intermediate supports. Countersink screws below top of plywood.

H. Lay Plyron, pre-drilled and counterbored, over sleepers and fasten with #10 flat head wood screws. Run panels parallel to sleepers and perpendicular to the plywood. Stagger panels 48" in adjacent rows. Align end joints over sleepers. Leave 1/8" gap all around each sheet. Stagger panels 24" on the short dimension and 48" on the long dimension from panels below. Space screws on 6" centers at supported edges and 12" centers over intermediate supports. Countersink screws below top of plywood.

I. Finish paint with two thin coats, Rosco Toughprime Black.

J. Provide rough openings, finished openings, and mortises for equipment set in the floor.

K. Cope the floor closely around obstructions, leaving a 1” expansion gap around obstructions. Where exposed, finish the floor edge straight and clean.

L. Leave a 1" expansion gap at walls for venting. Exception: at doors and adjacent flush floors fill the gap with solid cork filler for the full depth of the floor.

M. Install flooring flush with adjacent floors unless otherwise noted.

N. Provide wedge shims to achieve the specified overall thickness and level tolerances.

O. Where necessary, provide transitions at doors and adjacent fixed floors with a slope of 1:12 or shallower.
P. Clean thoroughly.

3.4 STAGE FLOOR TYPE ‘B’ INSTALLATION

A. Similar to Section 09 66 45; 3.3 except install plyron directly over existing wood stage flooring assembly eliminating additional plywood sub-flooring and wood 2x sleepers.

3.5 HARDBOARD SCREWS

A. Take precautions to prevent turning the heads off screws. Use high quality screws. Pre-drill and countersink the screws. Avoid using excess torque in driving the screws. Use a torque-limiting screwdriver. Where heads turn off the screws replace the screws using the following method:
   1. Remove and conserve the panel being installed.
   2. Drill out the broken screw in the layer below.
   3. Plug the hole with a solid tight-fitting wood plug fastened with glue.
   4. Pre-drill the subfloor plywood and patch for the replacement screw.
   5. Replace the panel being installed.
   6. Install the replacement screw.

3.6 CLEANING

A. Continuously maintain the work place in a clean, safe, and orderly condition.
B. Daily dispose of trash and waste materials in an acceptable manner.
C. Leave floor broom clean.

3.7 PROTECTION

A. Immediately after the floor finish has dried thoroughly, cover the floor with 1/4” hardboard.
B. Maintain the hardboard protection in good condition until no longer needed.

3.8 WASTE MANAGEMENT

A. Separate waste for recycling in accordance with the Waste Management Plan.

END OF SECTION
PART 1  GENERAL

1.1 SECTION INCLUDES

A. Carpet.
B. Accessories.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete: Floor substrate surface.
B. Section 09 65 00 - Resilient Flooring: Base finish and transition strips.

1.3 REFERENCES

B. ASTM E84 - Surface Burning Characteristics of Building Materials.
C. FS DDD-C-95 - Carpets and Rugs, Wool, Nylon, Acrylic, Modacrylic.
D. FS DDD-C-0095 - Carpet and Rugs, Wool, Nylon, Acrylic, Modacrylic, Polyester, Polypropylene.
E. FS DDD-C-1559 - Carpet, Loop, Low Pile Height, High Density, Woven or Tufted with Attached Cushioning.

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01 33 00.
B. Indicate seaming plan, method of joining seams, and direction of carpet.
C. Provide product data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
D. Submit samples under provisions of Section 01 33 00.
E. Submit two (2) samples 12 x 18 inch in size illustrating color and pattern for each carpet material specified.
F. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 01 73 00.
B. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning and shampooing.

1.6 WARRANTY

WCPS: Boonsboro High School Auditorium & Stage Renovations CARPET-GLUE DOWN 09 68 80-1
A. Manufacturer shall provide a full 10 year wear limited warranty on materials, workmanship, texture retention, and lifetime static warranty, lifetime wear warranty, lifetime edge ravel and zippering warranty, and a colorfast warranty.

1.7 QUALITY ASSURANCE
A. Manufacturer: Company specializing in woven tufted carpet with ten (10) years minimum experience.
B. Installer: Company with ten (10) years minimum documented experience and approved by manufacturer.

1.8 REGULATORY REQUIREMENTS
A. Conform to applicable code for carpet flammability requirements in accordance with ASTM E84.

1.9 ENVIRONMENTAL REQUIREMENTS
A. Store materials for three days prior to installation in area of installation to achieve temperature stability.
B. Maintain minimum 70 degrees F ambient temperature three days prior to, during, and 24 hours after installation of materials.

1.10 EXTRA MATERIALS
A. Provide 5% uncut stock of carpeting of each color specified, under provisions of Section 01 70 00.

PART 2 PRODUCTS
2.1 MANUFACTURERS
A. Specified Manufacturer – Carpet (Broadloom)
B. Substitutions: Under provisions of Section 01 60 00.

2.2 MATERIALS
A. Carpet (F2): Equal to J&J Flooring Group Tempo 2023 conforming to the following criteria:
   1. Wear Level 100% Encore SD Ultima Nylon
   2. Dye Method Solution Dyed
   3. Size 12 feet
   4. Gauge 1/12
   5. Backing Premier Bac Plus
   6. Flammability ASTM E648
   7. Smoke Density less than 450
   8. Color As selected from manufacturer's standard color palette by Architect

2.3 ACCESSORIES

09 68 80-2 CARPET-GLUE DOWN WCPS: Boonsboro High School Auditorium & Stage Renovations
A. **Sub-Floor Filler**: White premix latex premium; type recommended by carpet manufacturer.
B. **Primers and Adhesives**: Waterproof; of types recommended by carpet manufacturer. Low VOC content, mildew resistant, meeting current indoor air quality standards.
C. **Edge Strips**: Vinyl type, color as selected.
D. **Base Gripper**: Vinyl type, color as selected.
E. **Seam Sealer**: Solvent type as recommended by the carpet manufacturer.

### 2.4 WARRANTIES


### PART 3 EXECUTION

#### 3.1 EXAMINATION

A. Verify that substrate surfaces are smooth and flat with maximum variation of 1/8 inch in 10 ft and are ready to receive work.
B. Verify concrete floors are dry to a maximum moisture content of 7 percent; and exhibit negative alkalinity, carbonization, or dusting.
C. Beginning of installation means acceptance of existing substrate and site conditions.

#### 3.2 PREPARATION

A. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with sub-floor filler.
B. Apply, trowel, and float filler to leave smooth, flat, hard surface.
C. Prohibit traffic until filler is cured.
D. Vacuum floor surface.
E. Coordinate with mechanical contractor for maintaining proper ventilation during and after installation.

#### 3.3 INSTALLATION

A. Prior to installation, unwrap and unroll carpet in a well-ventilated location. Permit carpet to air 24 to 48 hours before actual installation.
   1. Airing can occur in the finished space through opening of the new windows and doors.
B. Continuously operate the building ventilation system at normal temperature and maximum outdoor air during installation and 72 hours after installation is complete.
C. Apply carpet and low VOC adhesive in accordance with manufacturers' instructions, with proper trowel as recommended by C.R.I.
D. Lay out rolls of carpet for approval.
E. Verify carpet match before cutting to ensure minimal variation between dye lots.
F. Double cut carpet, to allow intended seam and pattern match. Make cuts straight, true, and unfrayed. Edge seam carpet.
G. Locate seams in area of least traffic.
H. Fit seams straight, not crowded or peaked, free of gaps.
I. Lay carpet on floors with run of pile in same direction as anticipated traffic.
J. Do not change run of pile in any room where carpet is continuous through a wall opening into another room. Locate change of color or pattern between rooms under door center-line.
K. Cut and fit carpet around interruptions.
L. Fit carpet tight to intersection with vertical surfaces without gaps.

3.4 CLEANING
A. Remove access adhesive from floor, base, and wall surfaces without damage.
B. Clean and vacuum carpet surfaces per J&J Kinetex Micro-Maintenance Instructions.

3.5 PROTECTION
A. Prohibit traffic from carpet areas for 24 hours after installation.

END OF SECTION
PART 1  GENERAL

1.1  SECTION INCLUDES
   A. Surface preparation and field application of paints and coatings.

1.2  RELATED SECTIONS
   A. Section 05 12 00 - Structural Steel - Field finish.
   B. Section 05 21 00 - Steel Joist: Field finishing of exposed joist.
   C. Section 05 31 10 - Steel Roof Deck: Field finish of exposed deck.
   D. Section 05 50 00 - Metal Fabrications: Shop primed items.
   E. Section 05 51 00 - Metal Stairs - Field Finish.
   F. Section 05 52 00 - Handrails and Railings - Field Finish.
   G. Section 06 20 00 - Finish Carpentry - Field Finish.
   H. Section 06 41 00 - Custom Casework - Field Finish.
   I. Section 08 11 10 - Standard Steel Doors and Frames - Field Finish.
   J. Section 08 21 10 - Flush Wood Doors
   K. Section 09 26 00 - Gypsum Board Systems.
   L. Division 23 - Mechanical Identification. and Painting of Exposed Ductwork
   M. Division 26 - Electrical: Electrical Identification.

1.3  REFERENCES
   A. ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
   C. AWWA (American Water Works Association) - C204 - Chlorinated Rubber-Alkyd Paint Systems for the Exterior of Above Ground Steel Water Piping.
   D. AWWA (American Water Works Association) - D102 - Painting Steel Water Storage Tanks.
   E. NACE (National Association of Corrosion Engineers) - Industrial Maintenance Painting.
   G. PDCA (Painting and Decorating Contractors of America) - Painting - Architectural

H. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.

1.4 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this Section.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Provide data on all finishing products.

C. Samples: Submit two color chip selection catalogs illustrating range of colors available for each surface finishing product scheduled.

D. Manufacturer's Instructions: Indicate special surface preparation procedures, substrate conditions requiring special attention.

E. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten (10) years documented experience.

B. Applicator: Company specializing in performing the work of this section with minimum five (5) years documented experience and approved by manufacturer.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame and smoke rating requirements for finishes.

1.8 FIELD SAMPLES

A. Provide field sample of paint under provisions of Section 01 40 00.

B. Provide field sample classroom, illustrating special coating color, texture, and finish.

C. Locate where directed.

D. Accepted sample may remain as part of the Work.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
C. Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

D. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

D. Minimum Application TempePrature for Varnish and Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.11 EXTRA MATERIALS

A. Furnish under provisions of Section 01 73 00.

B. Provide 1 gallon of each color, and type to Owner.

C. Label each container with color, type, texture, room locations, and in addition to the manufacturer's label.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers - Paint
   1. PPG.
   2. Sherwin-Williams.

B. Manufacturers - Transparent Finishes
   1. Min-Wax.
   2. PPG Model REZ.
   3. Valspar

C. Manufacturers - Stain
   1. Min-Wax.
   2. PPG Model REZ.
   3. Valspar.

D. Manufacturers - Primer Sealers
   1. PPG - 6 Line.
   2. Benjamin Moore.
   4. Duron
E. Manufacturers - Block Filler
   1. PPG - Line.
   2. Benjamin Moore.

F. Substitutions: Under provisions of Section 01 60 00.

2.2 MATERIALS
   A. Coatings: Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sags.
   
   B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.
   
   C. Patching Materials: Latex filler.
   
   D. Fastener Head Cover Materials: Latex filler.

2.3 FINISHES
   A. Refer to schedule at end of section for surface finish schedule. Colors will be selected during construction.

PART 3 EXECUTION

3.1 EXAMINATION
   A. Verify site conditions under provisions of Section 01 31 00.
   
   B. Verify that surfaces and substrate conditions are ready to receive work as instructed by the product manufacturer.
   
   C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
   
   D. Test shop applied primer for compatibility with subsequent cover materials.
   
   E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
      1. Plaster and Gypsum Wallboard: 12 percent.
      2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

3.2 PREPARATION
   A. Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
   
   B. Correct defects and clean surfaces which affect work of this section. Remove existing coatings that exhibit loose surface defects.
   
   C. Seal with shellac and seal marks which may bleed through surface finishes.
D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

E. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.


G. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

H. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

I. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

J. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by power tool, wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.


L. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

M. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.

N. Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

3.3 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Do not apply finishes to surfaces that are not dry.

C. Apply each coat to uniform finish.

D. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

E. Sand wood and metal lightly between coats to achieve required finish.

F. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next
G. Allow applied coat to dry before next coat is applied.

H. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

I. Prime concealed surfaces of interior woodwork with primer paint.

J. Prime concealed surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

3.4 CLEANING

A. Clean work under provisions of 01 73 00.

B. Collect waste material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.5 INTERIOR PAINT SYSTEMS.

A. New Masonry:
   1. 1st Coat: Latex masonry block filler (PPG 6-7)
   2. 2nd & 3rd Coats: Latex Semi-gloss Enamel (PPG 6-510) 3.6 WFT/coat

B. Gypsum Board and Plaster:
   1. 1st Coat: Latex flat enamel (PPG 6-2): 3.6 WFT
   2. 2nd & 3rd Coats: Eggshell Latex enamel (PPG 6-411): 2.6 WFT/coat.

C. Ferrous Metals:
   1. 1st Coat: Primer - Speedhide Water Base Inhibitive Metal primer 90-712 white WFT 4.8 mils.
   2. 2nd & 3rd Coat: Pitt-Glaze Acrylic-Epoxy Semi-gloss coating, 16 line, WFT 6.0 mils.

D. Exposed Metal Structure Frame and Deck:
   1. 1st Coat: Primer - Speedhide Water Base Inhibitive Metal primer, 90-712 white, WFT 4.8 mils.
   2. 2nd & 3rd Coat: Speedhide latex dry fog flat spray paint, 6-715, white WFT 6.0 mils per coat.

E. Wood Doors and Trim (New):
   1. 1st Coat: Oil/Wiping Stain: Match existing wood with clear wood sealer.
   2. 2nd and 3rd Coats: Polyurethane Satin: (PPG 77-9) 3.0 WFT/coat

F. Wood Painted:
   1. 1st Coat (Primer): Enamel undercoater (PPG 6-6): 3.5 WFT/coat.
   2. 2nd & 3rd Coats: Semi-gloss Alykd Oil Based Enamel (PPG 6-90): 3.6 WFT/coat.

G. Metal Doors, Trim and Exposed Structural Steel:
   1. Touch-up existing primer.
   2. 2nd & 3rd Coats: Alkyd Lo-luster enamel (PPG 6-90) 3.5 WFT/coat.

H. New Masonry - Epoxy Finish:
1. First Coat: Pitt Glaze Block Filler (PPG 16-90): 25 mils WFT.
2. 2nd and 3rd Coats: Pitt Glaze Acrylic - Epoxy Semi-gloss Water Base Coating (PPG 16 line) 6.0 mils WFT per coat.

I. Stage Flooring (New):

3.6 EXTERIOR PAINT SYSTEMS

A. Ferrous metals (normal use and atmosphere).
   1. Location: All structural and miscellaneous steel, hollow metal doors and frames and fire hydrants and masonry lintels.
   2. System: Oil Alkyd (Low oil gloss).
      a. First Coat: Touch-up Primer: PPG 6-212 WFT 3.6
      b. Second and Third Coat: PPG Speedhide all purpose house paint WFT 4.0 mils per coat.

B. Zinc Coated Metal - Galvanized Steel
   1. Location: All exterior zinc coated or galvanized steel miscellaneous metals and lintels.
   2. System: Urethane/Acrylic
      a. Surface: Preparation SPG-9E
      b. Primer: Pitt-Tech 90-708 @ 5.1 WFT
      c. Finish (2 coats): Manor Hall 75-line @ 3.2 WFT per coat.

END OF SECTION
DIVISION 10

SPECIALTIES
PART 1  GENERAL

1.01  SECTION INCLUDES
   A. Fixed louvers and frames.
   B. Insect screening.
   C. Blank out sheeting.

1.02  RELATED SECTIONS
   A. Section 04 30 00 - Unit Masonry System: Prepared exterior wall opening.
   B. Section 05 40 00 – Cold Formed Metal Framing: Prepared exterior wall opening.

1.03  REFERENCES
   A. AMCA 500 (Air Movement Control Association) - Test Method for Louvers, Dampers, and Shutters.
   B. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate.
   C. ASTM A526 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
   D. ASTM A527 - Sheet Steel, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality.
   E. ASTM B209 - Aluminum-Alloy Sheet and Plate.
   F. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.

1.04  PERFORMANCE REQUIREMENTS
   A. Louver: To permit 50 percent free area.

1.05  SUBMITTALS
   A. Submit under provisions of Section 01 33 00.
   B. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blankout areas required, and frames.
   C. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.
   D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.06  QUALITY ASSURANCE
   A. Perform Work in accordance with AMCA Certification for louvers.

1.07  QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

1.08 FIELD MEASUREMENTS
A. Verify that field measurements are on shop drawings.

1.09 COORDINATION
A. Coordinate work under provisions of Section 01 31 00.
B. Coordinate the Work with installation of masonry flashings.
C. Coordinate the Work with installation of mechanical ductwork.

1.10 WARRANTY
A. Provide twenty year warranty under provisions of Section 01 74 00.
B. Warranty: Include coverage for degradation of fluoropolymer finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS
B. Airolite Arch. Louvers, Marietta, OH; Product: DRM6856.
C. Penn Ventilator Co., Inc., Philadelphia, PA
D. Substitutions: Under provisions of Section 01 60 00.

2.02 MATERIALS
A. Aluminum: 6063-T5 alloy, extruded shape; prefinished with shop applied fluoropolymer finish.

2.03 SCREENS
A. Insect Screen: Manufacturers Standard Interwoven wire mesh of aluminum.

2.04 ACCESSORIES
A. Fasteners and Anchors: Stainless steel type.
B. Primer: Zinc chromate, alkyd type.
C. Flashings: Of same material as louver frame.
D. Sealants: Type specified in Section 07 90 00.

2.05 FABRICATION
A. Louver Panel Thickness: 6 inches deep, face measurements as indicated.
B. Louver Blade Design: Sloped at 45 degrees; reinforced with intermediate stiffeners, material thickness of .081 inch minimum, integral and lateral rain water stops positioned on blade.
C. Louver Frame: Channel shape, welded corner joints, material thickness of .081 inch minimum.

D. Intermediate Mullions: Concealed of extruded aluminum, profiled to suit louver frame.

E. Head and Sill Flashings: Extruded to required shape, single length in one piece per location.

F. Screens: Install screen mesh in shaped frame, reinforce corner construction, shop install to louver with fasteners. Screens shall be mounted in a rewireable frame.

G. Blank-Out Sheeting on Interior of Louver: Same material as louver and frame:
   1. Configuration: Composite panel.
   2. Face Material: Aluminum.
   3. Core: Rigid polystyrene.
   4. Thickness: 1 inch.

2.06 FINISHES

   A. Exterior Aluminum Surfaces and Blank-Out Sheeting: Prepainted finish of Kynar 500 color as selected.

   B. Interior Steel Surfaces, Screens and Blank-Out Sheeting: Prepainted finish of Kynar 500 color as selected.

PART 3 EXECUTION

3.01 EXAMINATION

   A. Verify site conditions under provisions of Section 01 31 00.

   B. Verify that prepared openings and flashings are ready to receive work and opening dimensions are as indicated on shop drawings.

3.02 INSTALLATION

   A. Install louver assembly in accordance with manufacturer's instructions.

   B. Install louvers level and plumb.

   C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

   D. Secure louvers in opening framing with concealed fasteners, removable for maintenance purposes.

   E. Install insect screen and frame to interior of louver. Hinge screens for access.

   F. Install insect screen and frame to louvers. Install bird screens to exhaust and intake louvers.

   G. Install perimeter sealant and backing rod in accordance with Section 07 90 00.

3.03 ADJUSTING

   A. Adjust work under provisions of Section 01 73 00.
B. Adjust operable louvers for freedom of movement of control mechanism. Lubricate operating joints.

3.04 CLEANING

A. Clean work under provisions of 01 73 00.
B. Strip protective finish coverings.
C. Clean surfaces and components.

END OF SECTION
PART 1 – GENERAL

1.01 SUMMARY
A. Rigid vinyl sheet trim.

1.02 RELATED SECTIONS
A. Section 06 11 40 – Wood Blocking and Curbing.
B. Section 09 26 00 – Gypsum Board Systems.

1.03 REFERENCES
A. American Society for Testing and Materials (ASTM)
B. National Building Code of Canada (NBC)
C. National Fire Protection Association (NFPA)
D. Society of Automotive Engineers (SAE)
E. Underwriters Laboratory (UL)
F. Underwriters Laboratory of Canada (ULC)
G. Uniform Building Code (UBC)

1.04 SYSTEM DESCRIPTION
A. Performance Requirements: Provide rigid vinyl sheet systems that conform to the following requirements of regulatory agencies and the quality control of IPC Door and Wall Protection Systems™, InPro Corporation.
1. Fire Performance Characteristics: Provide UL Classified IPC Rigid Vinyl Sheet conforming with the NFPA Class A fire rating. Surface burning characteristics as determined by UL-723 (ASTM E-84), for IPC Rigid Vinyl Sheet installed with 3M Fastbond 30, InPro Bond Adhesive, or Formulated Solutions, LLC “XT-2000+” Adhesive shall be a maximum flame spread of 20 and a maximum smoke developed of 350 for .060” (1.5mm) thick material. Provide ULC (Canada) listed IPC Rigid Vinyl Sheet conforming to the requirements of the National Building Code of Canada 2010, Subsection 3.1.13. Surface burning characteristics, as determined by CAN/ULC-S102.2, shall be flame spread of 15 and smoke developed of 30.
2. Self Extinguishing: Provide rigid vinyl sheet with a CC1 classification, as tested in accordance with the procedures specified in ASTM D-635-74, Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position, as referenced in UBC 52-4-1988.
3. Provide sheet materials that have been tested and results filed in compliance with article 15, part 1120 of the New York State uniform fire prevention and building code. DOS # 09960-930.504.4001.
4. Impact Strength: Provide IPC Rigid Vinyl Sheet that has an Impact Strength of 30.4 ft-lbs/ inch of thickness as tested in accordance with the procedures specified in ASTM D-256-90b, Impact Resistance of Plastics.

5. Chemical and Stain Resistance: Provide rigid vinyl sheet that show resistance to stain when tested in accordance with applicable provisions of ASTM D-543.


7. Fungal and Bacterial Resistance: Provide rigid vinyl that does not support fungal or bacterial growth as tested in accordance with ASTM G-21 and ASTM G-22.

8. Color Consistency: Provide components matched in accordance with SAE J-1545 - (Delta E) with a color difference no greater than 1.0 units using CIE Lab, CIE CMC, CIE LCh, Hunter Lab or similar color space scale systems.

1.05 SUBMITTALS
A. Product Data: Manufacturer's printed product data for each type of IPC Rigid Vinyl Sheet specified.
B. Detail Drawings: Mounting details with the appropriate adhesives for specific project substrates.
C. Samples: Verification samples of IPC Rigid Vinyl Sheet, 8" (203mm) square, of each type and color indicated.
D. Manufacturer's Installation Instruction: Printed installation instructions for IPC Rigid Vinyl Sheet.

1.06 DELIVERY, STORAGE AND HANDLING
A. Deliver materials in unopened factory packaging to the jobsite.
B. Inspect materials at delivery to assure that specified products have been received.
C. Store in original packaging in a climate controlled location away from direct sunlight.

1.07 PROJECT CONDITIONS
A. Environmental Requirements: Products must be installed in an interior climate controlled environment.

1.08 WARRANTY
A. Standard IPC Limited Lifetime Warranty against material and manufacturing defects.

PART 2 - PRODUCTS
2.01 MANUFACTURER
A. Acceptable Manufacturer: IPC Door and Wall Protection Systems, InPro Corporation.
2.02 RIGID SHEET VINYL

A. Palladium® Rigid Vinyl Sheet
   1. Item No. 306, 3’x 8’, .060” = 1/16”
   2. Vinyl: Palladium® Rigid Vinyl Sheet shall be manufactured from chemical and stain resistant polyvinyl chloride with the addition of impact modifiers. No plasticizers shall be added (plasticizers may aid in bacterial growth).

B. Trim:
   1. Palladium 3D Boards
      a. Description, Thickness, Width, Length
         1) Horizontal Board - 1/2” thick, 6” wide, 96” long.
         2) Outside Corners - 3/8” thick, 4” wide, 96” long, 90°.
         3) Outside Corners - 3/8” thick, 4” wide, 96” long, custom angle TBD.
      b. Palladium 3D Boards: 3D boards shall be made from .040” IPC Rigid Sheet factory bonded to MDF Board. MDF board shall have No Added Urea Formaldehyde.

E. Finishes:
   1. Color or pattern of Palladium® Rigid Vinyl Sheet to be selected by the architect from the IPC Sheet finish selection. Surface shall have a velvet texture.
   2. Color or pattern of Palladium 3D Wall Boards to be selected by the architect from the IPC finish selection. Surface shall have a velvet texture. Back of 3D molding shall be black melamine.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions in which the rigid vinyl sheet will be installed.
   1. Complete all finishing operations, including painting, before beginning installation of rigid vinyl sheet materials.

B. Wall surface shall be dry and free from dirt, grease and loose paint.

3.02 PREPARATION

A. General: Prior to installation, clean substrate to remove dust, debris and loose particles.

3.03 INSTALLATION - RIGID VINYL SHEET

A. General: Locate the rigid vinyl sheet as indicated on the approved detail drawing for the appropriate substrate and in compliance with the IPC installation instructions. Install level and plumb at the height indicated on the drawings.

B. Installation of IPC Rigid Vinyl Sheet
   1. Adhere to substrate with InPro Bond, a freeze-thaw stable, nonflammable, high strength, water based adhesive that trowels on and allows approximately 20 minutes working time before firming.
   2. Adhere to substrate with XT-2000+, a freeze-thaw stable nonflammable, high strength, water based adhesive that trowels on and allows approximately 20 minutes working time before firming.
3. Adhere to substrate with Fastbond 30, a nonflammable, high strength, water-dispersed contact adhesive, with very little odor. Smooth roll surface.

3.08 CLEANING

A. At completion of the installation, clean surfaces in accordance with the IPC clean-up and maintenance instructions.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior Signage
B. Dedication Plaque.

1.02 SUBMITTALS

A. Submit shop drawings under provisions of Section 01 33 00.
B. Submit shop drawings listing sign styles, lettering and locations, and overall dimensions of each engraved sign.
C. Submit samples under provisions of Section 01 33 00.
D. Submit two samples illustrating full size sample sign, of type, style and color specified including method of attachment.
E. Submit manufacturer's installation instructions under provisions of Section 01 33 00.
F. Include installation template and hardware.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 01 60 00.
B. Store and protect products under provisions of Section 01 60 00.
C. Package signs, labeled in name groups.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Do not install signs when ambient temperature is below 70°F. Maintain this minimum during and after installation of signs.

PART 2 PRODUCTS

2.01 INTERIOR SIGNAGE

A. Specified Interior Signage Manufacturer:
   1. ASI Modulex, Baltimore, MD Impressions Plaques System with feature to allow installation of teacher's names and other modifications as detailed.

B. Other Acceptable Manufacturers
   1. American Graphics Inc. - Montgomery, Alabama
   2. Spanger.

C. Substitutions: Under provisions of Section 01 60 00.
D. Interior Signage (Raised Copy Signs): 1/16 inch clear matte acrylic that is sub-surface screen printed with a background color prior to being laminated to an opaque 1/4 inch base plate of either white or black acrylic and has a 1/16 inch thickness acrylic letter chemically welded to the front surface of the plaque. Copy shall be a minimum 5/8 inch high and comply with ANSI 117.1-4.30.
1. Doors not scheduled for signage per the door schedule shall receive a 2 x 3 inch sign indicating door number, as indicated by the Owner, to be located on door frame head, directly over the door latch.
2. Where signage is mounted on glazing, provide blank panel of same size and color to conceal adhesive mounting from interior.

E. Lettering:
1. Size and Style: Height of letter and numerals shall be as detailed, but not less then 5/8 inch; upper case text style as selected from ADA compliant test styles.
2. Colors: as selected.

F. Accessories
1. Tape Adhesive: silastic adhesive mounting for interior signage.

2.02 DEDICATION PLAQUE (BY ALLOWANCE)

A. Dedication Plaque: Cast Bronze Dedication Plaque as detailed on the construction drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Beginning of installation means installer accepts existing surfaces.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install signs after doors and surfaces are finished, in locations scheduled.

C. Locate signs adjacent to doors on wall, surface mounted in accordance with ANSI A117.1.

D. Clean and polish.

3.03 SCHEDULES

A. Provide signage as indicated on the door schedule and as detailed. Note that ALL doors receive signage indicating the door number. However, doors that receive both numerals and signage shall be a combined sign as detailed.

END OF SECTION
PART 1  GENERAL

1.01  SECTION INCLUDES

   A.  Fire extinguishers
   B.  Cabinets
   C.  Accessories.

1.02  PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

   A.  Section 04 30 00 - Unit Masonry System:  Placement of rough-in frame for cabinets.

1.03  RELATED SECTIONS

   A.  Section 06 11 40 - Wood Blocking and Curbing:  Wood blocking and shims.

1.04  REFERENCES

   A.  ANSI/NFPA 10 - Portable Fire Extinguishers.
   B.  ANSI/UL 92 - Fire Extinguisher and Booster Hose.
   D.  UL 8 - Foam Fire Extinguishers.
   E.  UL 154 - Carbon Dioxide Fire Extinguishers.
   F.  UL 299 - Dry Chemical Fire Extinguishers.
   G.  UL 626 - 2 2 Gallon Stored Pressure, Water Type Fire Extinguishers.
   H.  UL 1093 - Halogenated Agent Fire Extinguishers.

1.05  SUBMITTALS

   A.  Submit under provisions of Section 01 33 00.
   B.  Shop Drawings:  Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, wall bracket mounted measurements, location, and mounting heights.
   C.  Product Data:  Provide extinguisher operational features, color and finish, and anchorage details.
   D.  Manufacturer's Installation Instructions:  Indicate special criteria and wall opening coordination requirements.
   E.  Manufacturer's Certificate:  Certify that Products meet or exceed specified requirements.

1.06  OPERATION AND MAINTENANCE DATA

   A.  Submit under provisions of Section 01 73 00.
   B.  Maintenance Data:  Include test, refill or recharge schedules and recertification
1.07 QUALITY ASSURANCE
   A. Provide units conforming with ANSI/UL 711.

1.08 REGULATORY REQUIREMENTS
   A. Conform to ANSI/NFPA 10 for requirements for extinguishers.

1.09 ENVIRONMENTAL REQUIREMENTS
   A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Larsen's Product
   B. Modern Metal Products.
   C. J.L. Industries.
   D. Substitutions: Under provisions of Section 01 60 00.

2.02 EXTINGUISHERS
   A. MP10 Dry Chemical Type: UL 299, Cast steel tank, with pressure gage; Class 4A-60B:C.
   B. Food Service area to be WC-6L Wet Chemical Type, Class K Rated.

2.03 CABINETS
   A. Metal: Formed stainless steel; 18 gage thick base metal.
   B. Configuration:
      1. For MP10 Extinguisher: Equal to Larsen's Cameo C2409-5R semi-recessed type, exterior nominal dimensions of 13 inches wide x 27 2 inches high and rough opening depth of 2 3/4 inches.
      2. For WC-6L Extinguisher: Equal to Larsen’s Cameo Series C3216-R recessed type, exterior nominal dimensions of 19 1/2 inches wide x 35 1/2 inches high and rough opening depth of 4 inches.
   C. Trim Type: Semi-recessed, returned to wall surface. Recess in wall must not exceed 4 inches.
   D. Door: 18 gage stainless steel, clear bubble break glass.
   E. Door Glazing: Plastic, clear, 1/8 inch thick acrylic.
   F. Cabinet Mounting Hardware: Manufacturer's standard bracket.
   G. Provide rated cabinets where located in fire rated partitions.

2.04 ACCESSORIES
A. Extinguisher Brackets: Formed steel, chromed finish.

2.05 FABRICATION

A. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.
B. Pre-drill for anchors.
C. Hinge doors for 180 degree opening with continuous piano hinge. Provide nylon roller type catch.
D. Weld, fill, and grind components smooth.
E. Glaze doors with resilient channel gasket glazing.

2.06 FINISHES

A. Extinguisher: Steel, enamel to red color.
B. Cabinet Exterior Trim and Door: Stainless Steel No. 4 finish.
C. Cabinet Interior: white enamel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify wall openings under provisions of Section 01 31 00.
B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install cabinets plumb and level in wall openings, 48 inches from finished floor to inside top of cabinet.
C. Secure rigidly in place.
D. Place extinguishers in cabinets on wall brackets.

END OF SECTION
PART 1   GENERAL

1.1   SECTION INCLUDES

A.   Toilet and washroom accessories.

B.   Grab bars.

C.   Attachment hardware.

1.2   PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A.   Section 04 81 00 - Unit Masonry Assemblies: Placement of concealed anchor devices.

B.   Section 09 11 10 - Metal Stud Framing System: Placement of concealed anchor devices.

1.3   RELATED SECTIONS

A.   TBD.

1.4   REFERENCES


D.   ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

E.   ASTM A366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.


G.   NEMA LD-3 - High Pressure Decorative Laminates.

1.5   SUBMITTALS

A.   Submit under provisions of Section 01 33 00.

B.   Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.

C.   Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.
1.6 REGULATORY REQUIREMENTS
   A. Conform to ANSI A117.1 code for access for the handicapped.

1.7 FIELD MEASUREMENTS
   A. Verify that field measurements are as indicated on product data and instructed by the manufacturer.

1.8 COORDINATION
   A. Coordinate work under provisions of Section 01 31 00.
   B. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

PART 2 PRODUCTS

2.1 MANUFACTURERS
   A. Bobrick, Product as specified.
   B. Other acceptable manufacturers offering equivalent products.
      2. Bradley.
      3. Parker.
   C. Substitutions: Under provisions of Section 01 60 00.

2.2 MATERIALS
   A. Sheet Steel: ASTM A366.
   B. Stainless Steel Sheet: ASTM A167, Type 304.
   C. Tubing: ASTM A269, stainless steel.
   D. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof, and security type.
   E. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.3 FABRICATION
   A. Weld and grind joints of fabricated components, smooth.
   B. Form exposed surfaces from single sheet of stock, free of joints. Form surfaces flat without distortion. Maintain surfaces without scratches or dents.
   C. Fabricate grab bars of tubing, free of visible joints, return to wall with end attachment flanges. Form bar with 1 1/2 inches clear of wall surface. Knurl grip surfaces.
D. Shop assemble components and package complete with anchors and fittings.
E. Provide steel anchor plates, adapters, and anchor components for installation.

2.4 KEYING
A. Supply six (6) keys for each accessory to Owner.
B. Master key all accessories.

2.5 FINISHES
B. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
C. Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats electrostatic baked enamel.
D. Chrome/Nickel Plating: ASTM B456, Type SC 2 satin finish.
E. Stainless Steel: No. 4 satin luster finish.
F. Back paint components where contact is made with building finishes to prevent electrolysis.

PART 3 EXECUTION
3.1 EXAMINATION
A. Verify site conditions under provisions of Section 01 31 00.
B. Verify that site conditions are ready to receive work and dimensions are as indicated on shop drawings and instructed by the manufacturer.
C. Verify exact location of accessories for installation.

3.2 PREPARATION
A. Deliver inserts and rough-in frames to site for timely installation.
B. Provide templates and rough-in measurements as required.

3.3 INSTALLATION
A. Install accessories in accordance with manufacturers' instructions and ANSI A117.1.
B. Install plumb and level, securely and rigidly anchored to substrate.
3.4 SCHEDULE (See drawings for locations).

1. Toilet Paper Dispenser           Owner provided, Contractor installed
2. Mirror (18” x 30”)                Bobrick B-165 18” x 30”
3. Paper Towel Dispenser            Owner provided, Contractor installed
4. Soap Dispenser (Wall Mounted)    Owner provided, Contractor installed
5. Grab Bars:
   (Toilet)
   a. 36” Grab Bar                   Bobrick B-6806-36
   b. 42” Grab Bar                   Bobrick B-6806-42
   c. 18” Vertical Grab Bar          Bobrick B-6806-18
6. Sanitary Napkin Disposal         Bobrick B-270
7. Robe Hook:                       Bobrick B-76717
8. Waste Receptacle (Surface)       Owner provided, Contractor installed

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES
   A. Projection Screens
   B. Acoustical Panels
   C. Projection and Viewport Windows
   D. Sliding Service Window

1.2 PRODUCTS FURNISHED BUT NO INSTALLED UNDER THIS SECTION
   A. Division 23 - Mechanical: Connection of Utilities
   B. Division 26 - Electrical: Connection of Utilities

1.3 SUBMITTALS
   A. Submit shop drawings under provisions of Section 01 33 00.
   B. Submit shop drawings indicating acoustical panels layout, port window layout and details, and projection screen layout including utility requirements.
   C. Submit product data under provisions of Section 01 33 00
   D. Submit product data for acoustical panels, projection screens, and port windows.
   E. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.4 OPERATION AND MAINTENANCE DATA
   A. Submit operation data under provisions of Section 01 73 00.
   B. Submit maintenance data under provisions of Section 01 73 00.
   C. Include cleaning and stain removal methods and recommended cleaning materials, polishes and waxes.

1.5 DELIVERY, STORAGE AND HANDLING
   A. Deliver products to site under provisions of Section 01 60 00.
   B. Store and protect products under provisions of Section 01 60 00.

1.6 WARRANTY
   A. Provide one (1) year warranty under provisions of Section 01 74 00.

1.7 SUBSTITUTIONS
   A. Substitutions shall be in accordance with Section 01 60 00.
PART 2 PRODUCTS

2.1 PROJECTION SCREEN

A. Projection screen, to be located at the stage, shall be equal to Da-Lite’s Senior Electrol, 21'-0" wide by 10'-0" high, weight 284 lbs with matte white viewing surface.
   1. Unit shall be 120 V A/C electrically operated by key operated switch.
   2. Provide recessed above ceiling mounting.

2.2 ACOUSTICAL PANELS

A. Equal to Wenger Corporation, absorber panel, fabric wrapped (Class A) with reinforced edges.
   1. Nominal Dimensions:
      a. Qty (16) 4x4 (AWA 1) 3” wall absorber
      b. Qty (14) 3x4 (AWA2) 3” wall absorber
      c. Qty (7) 2x4 (AWA 3) 3” wall absorber
      d. Qty (2) 4x6 (AWA 4) 3” wall absorber
      e. Qty (2) 3x3 (AWA 5) 3” wall absorber
      f. Qty (22) 4x4 (AWD 1) wall diffuser
   2. Mounting Type: 2 clip.

2.3 PREMIUM METAL PROJECTION AND VIEW PORTS

A. Projection and view ports (Type ‘F’) window to be located in modified openings in 104-Projection. Refer to drawings. Shall be equal to Goldberg Brothers Inc. Dual Window Projector Port; Goldberg Inc., Denver, Co.; Phone: 303-321-1099
   1. Dual Window Port: Adjustable wall port with one part projection with inner removable glass frame mounted at 5° angle and one part view with opening glass door with glass mounted at 0° angle.
   2. Dimensions: As indicated on drawings.
   3. Frame Material: Cold rolled 16 gauge formed steel frame, welded corners, dressed smooth.
   4. Glass Frame: One piece 16 ga. formed steel outer bezel with one piece 14 ga. inner frame sandwiched around glass and connected by screws for easy replacement of glass. Glass frame to have two easy grip handles and secured in place to frame glass stop by panel captive fasteners.
   5. Glass Frame Stop: One piece 14 ga. formed steel frame, spot welded to port frame and dressed smooth.
   6. Outer Glass Door: Two piece 16 ga. formed steel frame sandwiched around glass and connected by screws for easy replacement of glass. Glass door frame hinged to port frame and secured by two compression latches.
   7. Coatings: All steel port frame and glass frame parts cleaned and powder coated – Polyester TGIC Black 20% gross.
   8. Glass: 10 mm optical low iron water white float glass with 6x magnetron sputtered anti-reflective coatings applied both sides (not sprayed on), 95% light transmission as manufactured by Flabeg, Flabeg Technical Glass US Corp., Church + Bridge Streets, P.O. Box 71, Naugatuck, CT 06770; Phone: 1-203-729-5227; www.flabeg.com
   9. Glass Gasket: Closed cell foam Neoprene gasket both sides of glass and between glass frame and frame stop.
   10. Installation: Install port frames and glass by experienced installer per manufactures recommended installation procedures. Installer to inspect port and port components for any defects that
11. **Sound Insulation:** Additional sound insulation between port frame and wall to be supplied and installed by contractor. Contractor shall coordinate with acoustical contractor for proper sound insulation to be installed around port frame.

12. **Warranty:** Port frames and components, including glass, to carry a one year manufacture’s workmanship warranty limited to repair or replacement of defective. Glass to carry a limited life of installation warranty, limited to anti-reflective coated glass only and limited to the loss of the anti-reflective properties while properly maintained.

### 2.4 SLIDING SERVICE WINDOW

A. Equal to C.R. Laurence (CRL) self-closing deluxe sliding service window, SCDW 1804, C.R. Laurence Architectural Products; Phone: 1-800-421-6144; [www.crlaurence.com](http://www.crlaurence.com).

1. **Sections:** Heavy duty extruded aluminum 6063-T6. Frame has a narrow depth of 4-1/2”, center siteline has a narrow 1-1/2” frame. Window: Top rail, bottom rail, center and end stiles 15/16”. Weather proof poly-pile. Thumbturn lock included.

2. **Mechanics:** Heavy duty ball bearing carrier for sliding window.

3. **Glazing:** Refer to drawings.

4. **Finish:** Satin Anodized (A).

5. **Options:** Stainless steel shelf with deal tray, speak thru louvered hole (refer to drawings).

6. **Dimensions and Configuration:** Refer to Drawings.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

A. Verify that openings are ready to receive work.

B. Verify field measurements are as shown on shop drawings.

C. Verify that required utilities are available, in proper locations, and ready for use.

D. Beginning installation means installer accepts existing substrate conditions.

#### 3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

#### 3.3 CLEANING

A. Clean work under provisions of Section 01 73 00.

#### 3.4 PROTECTION

A. Protect finished installation under provisions of Section 01 50 00.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Shade Type 1: Manually operated interior roller-screen solar shades as indicated in schedule at end of section.

B. Products Supplied But Not Installed Under This Section:
   1. Metal shade pockets or housings recessed into ceiling system or assembly.
   2. Extruded aluminum ceiling pocket trim (closure) assemblies.

C. Related Sections:
   1. Section 06 11 40 – Wood Blocking and Curbing: Blocking for support of window shade brackets or pocket assemblies.
   2. Section 09 26 00 - Gypsum Board Systems: Substrate for window shade systems and installation of shade pockets, pocket closure and/or accessories supplied only under this section.

1.2 PERFORMANCE REQUIREMENTS

A. Fire: Provide shade fabrics tested in accordance with:
   1. 1989 NFPA 701 small scale Vertical Burn Test and rated "PASS."
   2. 1996 NFPA 701 small scale Vertical Burn (telephone booth test) and rated "PASS."

B. Toxicity: Provide shade fabrics tested in accordance with University of Pittsburgh Toxicity Protocol including LC50 analysis and toxicity characteristics.

C. Anti-microbial:
   1. ASTM G-22-80 results for ATCC6538 (Staphylococcus aureus) and ATCC13388 (Psuedomonas aeroginosa) indicating minimum 5mm (0.197 inches) "No Growth Contact Area".
   2. ASTM G-21-85 results for ATCC9642, ATCC9644, ATCC9348 and ATCC9645 indicating "No Growth".

1.3 SUBMITTALS

A. Product Data: Manufacturer’s product data sheets, performance data, and installation instructions for each item required per section 01 34 00.

B. Shop Drawings:
   1. Interior Elevations at 3/8” = 1’-0” scale min indicating shade layout, seam / batten locations and coordination with surrounding conditions.
   2. Floor plans or reflected ceiling plans showing overall arrangement of shades and control locations.
   3. Head, Jamb and sill details as necessary to coordinate work with surrounding conditions and construction.
   3. Shade schedule coordinating room number, window type, opening size(s), quantities and key to details.

C. Samples:
   1. Selection samples:
      a. 3” X 5” (76 mm x 127 mm) shadecloth fabric swatches for initial fabric color selection from manufacturer’s full range of available fabrics.
b. Standard aluminum finish color samples from manufacturer’s range of standard colors.

2. Verification samples:
   a. One fully operational window shade sample of each type required 30” X 30” (760 mm x 760 mm) complete with selected shadecloth including sample of seam / batten when applicable. Disassemble sample to demonstrating compliance with PART 2.
   b. One complete set of all shade components, unassembled, demonstrating compliance with PART 2.

D. Design Data, Test Reports, Certificates: Current reports from independent testing laboratories demonstrating compliance with article 1.2.

E. Manufacturers’ Instructions: Manufacturer’s standard installation instructions.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: 20 years minimum experience manufacturing products comparable to those specified in this section.
   2. Installer: 20 years minimum experience installing products comparable to those specified in this section.

B. Field Samples: Install large size sample of selected fabric for final verification of color, weave and density, in opening as directed by design professional.

C. Do not fabricate shades without obtaining field dimensions for each opening. Coordinate construction of surrounding conditions to allow for timely field dimension verification.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection:

B. Do not deliver items to the project until all concrete, masonry, plaster, painting and other wet work has been completed and is dry.

C. Deliver shades to project in labeled protective packaging. Uniquely labeled to identify each shade for each opening. Schedule delivery to prevent delays to completion of work but to minimize on site storage time.

D. Store materials in a dry secure place. Protect from weather, surface contaminants, corrosion, construction traffic and all other potential damage.

1.6 WARRANTY

A. Special Warranty:
   1. Manual Operating Components: Provide Manufacturer’s warranty under provisions of Division 1 - General Requirements. Warranty period to be 25 years from Date of Substantial Completion and contain provisions that installation is to remain operational without fault for the warranty period and include all operating parts, including shadecloth, except for the bead chain which is not covered by the warranty and is deemed to be a maintenance / service item.
   2. Installation: Provide Contractor’s warranty under provisions of Division 1 - General Requirements that installation shall be free from defects for a period of not less than 1 year.
   3. In the event of a warranted product failure, the Shade Contractor will, at
no cost to owner, facilitate acquisition and delivery of all necessary components to the owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Mechoshade Systems, Inc. (Basis of Design)
B. Neikirks of Hagerstown
C. Hunter Douglas
D. Substitutions: Under provisions of Section 01 60 00.

2.2 COMPONENTS

A. Shadebands: Construction of shadeband includes the fabric, the hembar and hempocket, and the attachment of the shadeband to the roller tube:
   2. Hembars and Hempockets: Fabric hempocket with RF - welded seams (including welded ends) and concealed hemweights. Hemweights must be of appropriate size and weight for shadeband and must be continuous inside a sealed hempocket. Match hempocket construction for all shades in same rooms.

3. Motorized Shade Hardware and Shade Brackets:
   a. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel, or heavier, thicker, as required to support 150 percent of the full weight of each shade. Plastic components without use of steel angle construction do not meet the intent of this specification and shall not be accepted.
   b. Provide shade hardware system that allows for field adjustment of EDU or replacement of any operable hardware component without requiring removal of brackets, regardless of mounting position (inside, or outside mount).
   c. Provide shade hardware system that allows for operation of multiple shade bands offset by a maximum of 8-45 degrees from the EDU axis between shade bands (4-22.5 degrees) on each side of the radial line, by a single shade EDU (multi-banded shade, subject to manufacturer’s design criteria).

   All bands within a single EDU group shall be aligned within 1/4 inch.

B. Manually Operated Hardware and Shade Brackets:
   1. Provide for regular and offset drive capacity (chain fall at front or rear of bracket) on all shade drive end brackets.
   2. Provide shade hardware system that allows for removal of shade roller tube from brackets without removing hardware from opening.
   3. Provide shade hardware that allows for removal and re-mouting of the shade band without having to remove shade tube, drive or operating support brackets.
   4. Provide hardware for installation of a removable fascia, regular or reverse roll, which shall be installed without exposed fastening devices of any kind.
   5. Provide shade hardware system that allows for a removable regular and/or reverse roll fascia(s) to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind;
   6. Provide shade hardware system that allows for operation of multiple shadebands by a single chain (Multi-banded shades) operator subject to
manufacturer’s design criteria. Connectors shall be offset to assure alignment from the first to the last shade band.

7. Provide shade hardware system that allows multi-banded manually operated shades to be capable of smooth operation when the axis is offset a maximum of 6° on each side of the plane perpendicular to the radial line of the curve (12° total offset).

8. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connections for drive mechanism to shade roller tube shall not be accepted.

9. Provide shade hardware constructed of minimum 1/8” (3.18 mm) thick cadmium plated steel or heavier as required to support 150% of the full weight of each shade.

10. Provide only Delrin engineered plastics by DuPont for all plastic components of the shade hardware. Styrene polyester and ABS based plastics are not acceptable.

11. Drive Bracket/Brake Assembly:
   a. MechoShade Drive Bracket model 5 shall be fully integrated with all MechoShade Wide accessories and brackets, including but not limited to Fascia, Black Out channels center supports and connectors for multi-band shade operation etc.
   b. M5 bracket shall use the standard 1/8 inch (3.175mm) steel plate for mounting and support of the assembly. The drive sprocket and brake assembly shall rotate and be supported on a welded 3/8 inch steel pin (9.525mm).
   c. The brake means shall be an over running clutch design which shall disengage to 90% during the raising and lowering of a shade. The brake shall with stand a pull force of 50 lbs. (22kg) in the stopped position.
   d. The braking (patent pending) means shall be applied to a oil impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly which assures smooth, non-jerky operation in raising and lowering the shades. The brake assembly is warranted for the life of the system, which is in itself warranted to be fit for the use intended for 25 years.
   e. The entire MechoShade 5 assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled with out effecting the roller shade limit adjustments.

C. Shade roller and shadecloth attachment:
   1. Provide an extruded aluminum shade roller tube of diameter and wall thickness required to support shade fabric without (excessive) deflection. Roller tubes less than 1.55” in diameter are not acceptable. Tube shall have two asymmetrical channels for mounting of the shade band spline.
   2. Provide for positive mechanical engagement with drive / brake mechanism.
   3. Provide for positive mechanical attachment of shade band to roller tube without the use of adhesives, adhesive tape, staples or rivets. Two sided pressure sensitive adhesive tape shall not be acceptable. Shade bands stapled to roller tubes shall not be acceptable. A mounting method that does not readily allow the shade band to be removed from the shade tube while installed shall not be acceptable.
   4. Attach shadebands to tube in such a way that removal and replacement of a shadeband can be accomplished without removing either the tube from the brackets or without removing shade brackets. Shadebands must be replaceable on site without removing shade tube or brackets.

D. Drive Chain: #10 Qualified stainless steel chain rated to 90 pound (41 kg) minimum breaking strength.
2.3 ACCESSORIES

A. Fascia:
   1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
   2. Fascia shall be able to be installed across two or more shade bands in one piece.
   3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
   4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.

2.4 FABRICATION

A. Fabricate units to completely fill existing openings from head to sill and jamb to jamb, unless specifically indicated otherwise. Comply with Manufacturer’s edge clearance standards and recommendations.

B. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch in either direction per 8 feet of shade height due to warp distortion or weave design.

C. Provide battens in non-railroaded shades as required by the Manufacturer to assure proper tracking and uniform rolling of the shadebands, in accordance with the manufacturer’s published width x height shade fabrication guide and standards.

D. For railroaded shadebands, provide seams or battens in railroaded multi-width shadebands as required by Manufacturer to meet Width:Height ratios and size requirements. Unless specified elsewhere, manufacturer’s standard seam / batten placements are acceptable to Design Professional. If custom placement of seams / battens is required, coordinate these locations with design requirements.

E. Provide batten pockets utilizing self-colored fabric front and back, RF welded into the shadecloth. Provide a self-colored opaque liner front and back to eliminate any see through of the batten pocket and shall not exceed 1-1/2 inches (38 mm) high and be totally opaque. A see-through moiré effect which occurs with multiple layers of transparent fabrics are not acceptable. Reinforce batten pockets using coil coated, roll formed spring steel to insure flatness of shadebands in accordance with manufacturer’s standards. Concave formed profile of batten stiffeners to be compatible with diameter of shade roller tube.

2.5 FINISHES

A. Aluminum Components: Design Professional shall select from Manufacturer’s standard PPG Duracron baked enamel colors to match existing.

B. Steel Components: Cadmium-plated, satin-finished, or bonderized prior to painting with Manufacturer’s standard baked-enamel finish.

PART 3 EXECUTION

3.1 EXAMINATION
A. Examine substrate and conditions for installation. Do not commence installation until conditions are satisfactory. Commencement of installation indicates acceptance of site conditions by Contractor. Notify the Design Professional upon inspection when the project conditions are unacceptable for shade installation. "Beginning of installation" means acceptance of substrate and project conditions.

3.2 INSTALLATION

A. Install units to comply with the Manufacturer's instructions for the type of mounting and operation required. Provide units plumb, true, and securely anchored in place with recommended hardware and accessories to provide smooth operation without binding.

B. Install units within the following tolerances:
   1. Maximum variation of gap at window opening perimeter: 1/4 inch, per 8 feet (+/- 1/8 inch) of shade height.
   2. Maximum offset from level: 1/16 inch per 5 feet of shade width.

3.3 ADJUSTING

A. Adjust drive / brake mechanism of units for smooth operation. Adjust shade and shadecloth to hang flat without buckling or distortion. Replace any units or components which do not hang properly or operate smoothly.

3.4 CLEANING

A. Touch up damaged finishes and repair minor damage in order to eliminate evidence of repair. Remove and replace work that cannot be satisfactorily repaired.

B. Clean exposed surfaces, including metal and shadecloth, using non-abrasive materials and methods recommended by the Shadecloth Manufacturer. Remove and replace work which cannot be satisfactorily cleaned.

3.5 DEMONSTRATION

A. Demonstrate operation method and instruct Owner's personnel in the proper operation and maintenance of the window shade systems.

3.6 SCHEDULES

A. Shade Type 1 – All exterior windows, storefront, and curtainwall.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF WORK

A. The work to be performed under these Specifications shall include providing all labor, materials, and equipment necessary to furnish and install, complete, properly, and fully all plumbing work as shown on the Drawings or herein specified. It is the intent of these Specifications that a complete operating system be installed; this Contractor shall carefully examine the site, drawings, and Specifications, and shall include all items necessary to accomplish this purpose. The work, in general, shall include, but shall not be limited to the following:

1. Provide new interior sanitary and vent. Connect to existing interior sanitary and vent.

2. Provide interior domestic cold and hot water distribution systems as indicated. Provide valves. Connect to existing system.

3. Provide primary storm and overflow piping.

4. Provide new Primary/Overflow Roof drains.

5. Provide new plumbing fixtures and equipment shown.

6. Provide plumbing services and final connections for equipment furnished under various Contracts or by the Owner as indicated.

7. Provide insulation for piping as specified.

8. Testing, adjusting and balancing all plumbing piping and equipment.

9. Provide all necessary demolition of existing piping and fixtures as indicated.

1.3 WORK BY OTHER TRADES

A. Cutting, patching, painting, electrical, plumbing, etc., shall be done by the affected trade at this Contractor’s expense for changes required in work already installed or work required by other trades for changes made by this Contractor in type or size of equipment purchased.

1.4 WORK NOT INCLUDED

A. The following construction and equipment related to the work under this Contract will be provided by others:
1. Furring around piping. (General Contractor)
2. Final painting of interior surfaces. (General Contractor)
3. Recesses and openings in construction for plumbing piping and equipment.

PART 2 – PRODUCTS

2.1 NOT APPLICABLE TO THIS SECTION

PART 3 – EXECUTION

3.1 NOT APPLICABLE TO THIS SECTION

END OF SECTION
SECTION 22 05 00 – BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary
   Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 PLUMBING WORK

A. These Specifications are issued to cover all work in connection with the complete installation
   of the plumbing work. Plumbing work is hereby defined to include work as herein specified
   and as shown on the Drawings issued in connection with this project. Any reference in these
   Specifications to the Contractor shall hereby be considered a reference to the Plumbing
   Contractor. Any reference or letting of work to subcontractors or manufacturers in these
   Specifications does not relieve the Contractor of his responsibility for the work, materials, and
   equipment under this Contract. The Plumbing Contractor is responsible for the work and
   performance of his subcontractors.

B. The word “building” used throughout these Specifications shall be interpreted to mean the
   entire Building Complex.

C. The actual runs and locations of all piping, equipment, and materials shall be determined at the
   site and shall be installed to meet the various conditions at the building. It is, however, the
   Contractor's responsibility to predetermine the exact locations of piping and equipment, and to
   notify the other contractors accordingly and prior to any installation to avoid confliction with
   other piping and equipment. Any changes necessary to conceal pipes or clear pipes and
   equipment of other trades shall be made without additional expense to the Owner.

D. All work shall be executed and all equipment constructed and installed in accordance with the
   requirements of the Maryland Department of Labor and Industry, applicable IBC Codes, the
   Maryland Department of Environmental Protection, ASME, the Department of Labor, Safety
   and Health Regulations for Construction, OSHA, the National Fire Protection Association, the
   National Electrical Code as amended to date of bidding, and all applicable federal, state, county
   and local ordinances and regulations. Nothing contained in these Specifications or shown on
   the Drawings shall be construed to conflict with the aforesaid codes, ordinances, or regulations.
   Certificates of approval shall be obtained from any department issuing same, and shall be
   turned over to the Owner at the completion of the work. All fees and permits required shall be
   satisfied and obtained by the Contractor and the cost shall be included in the Contract price.

E. The Contractor shall carefully examine the general building drawings, all mechanical and
   electrical drawings, and carry on his work so as not to delay or interfere with the work of other
   trades. The Contractor shall obtain in writing from the other contractors such data as is
   necessary to coordinate his work with other branches. This coordination must take place prior
   to any piping or equipment installation. As the work in the building nears completion, all
   threading, cutting, and similar work shall be done where directed by the Architect. Upon
   completion of the work, all remaining waste materials and rubbish resulting from the Contract
   work shall be removed from the building and premises.
F. Where the phrase "or approved equivalent," "or equivalent," or "approved" appears in these Specifications, it shall refer to the prior to bidding approval of the Architect/Engineer on the material or equipment involved. Substitutions of non-named suppliers after bidding shall be summarily rejected.

G. The term "Provide" means to furnish and install. The term "Furnish", used separately, means to obtain and deliver on the job for installation by other trades.

H. The General Contractor will provide chases and openings in walls, floors, ceilings, and partitions of new construction to receive pipe piping, risers, and other equipment insofar as it is possible to predetermine the exact location, but the Contractor shall install his work sufficiently in advance of the building construction to permit his work to be built into place. The Contractor shall advise the General Contractor of the exact size and location of all chases and openings required for the installation of his work, and shall check size and location of all such chases and openings provided by the General Contractor.

I. The Contractor shall furnish and place all sleeves required for pipes passing through new floors, walls and ceilings before such general construction work is built into place. The Contractor shall place all inserts required for hangers and supports, as the construction work progresses, so that unnecessary cutting of construction work will be eliminated.

J. Equipment and materials of similar types shall be of the same manufacturer unless specifically indicated otherwise on the Drawings or herein specified. The Contractor shall make final connections between all equipment furnished under this Contract and equipment furnished under other contracts, except as otherwise specified herein.

K. The materials used throughout shall be those of reputable manufacturers and shall be the best of their respective kinds. All equipment, components and materials shall be installed in a neat and workmanlike manner in accordance with best trade practices, manufacturer’s recommendations, and applicable codes and standards and by persons skilled in each particular branch of the work assigned to them. All work shall be installed subject to the approval of the Architect.

L. All piping work shall be installed plumb, level, and square per code requirements. All piping shall be run in straight horizontal or vertical sections, outside of sloped drainage piping, and shall be under inspection during installation. Any piping, fittings, hangers, and/or systems deemed unacceptable per inspection during installation shall be repaired, replaced, and corrected with no additional cost to the project.

M. A complete list of materials proposed for each installation shall be submitted to the Architect for approval before delivery to the site. The Contractor shall submit samples of materials for approval at the site as requested by the Architect. Such materials may be incorporated into the structures after serving their purpose as samples.

N. Where the Contractor elects to substitute approved materials or equipment for materials or equipment specified, the Contractor will be held responsible for all architectural, structural, mechanical, and electrical changes required for their installation at no additional cost to the Owner. If additional engineering design is required, the Contractor shall reimburse the design engineer all costs.

O. The Contractor shall be entirely responsible for all apparatus, equipment and appurtenances furnished by him or his Subcontractors in connection with the work, and special care shall be
taken to protect all parts thereof in such manner as may be necessary or as may be directed. Protection shall include covers, crating, sheds, or other means to prevent dirt, grit, plaster, or other foreign substances from entering the working parts of machinery or equipment. Special care shall be taken to keep all open ends of pipes, etc., closed while in storage and during installation. Where equipment must be stored outside the building, it shall be totally covered and secured with heavy waterproof tarps and kept dry at all times. Where equipment has been subject to moisture, it shall be suitably dried out before placed in service. Rusted piping, interior or exterior of piping, will not be permitted for installation. Equipment with rusted finishes will not be permitted before or after installation. Materials and equipment shall be stored in areas designated by the Architect.

P. The Contractor or his subcontractors will not be permitted to use corridors as storage areas for their piping, materials, or equipment. Piping, materials, and equipment shall be stored in areas as coordinated with the Architect.

Q. Grades, elevations and locations shown on the Drawings are approximately correct; however, the Contractor shall field check and otherwise verify all such data at the site before proceeding with the work. The Contractor shall make necessary survey equipment available at all times and shall make use of such equipment wherever necessary to properly install his piping or equipment.

R. The Contractor shall visit the site and thoroughly acquaint himself with conditions existing at the site before submitting his proposal as will be held responsible for the installation of the work complete in every detail. The Contractor shall especially review the Architect’s phasing schedule and ensure compliance with this schedule.

S. All work shown on the Drawings and not specifically included in the Specifications shall be considered a part of the Contract work. All work included in the Specifications and not specifically included on the Drawings shall also be considered a part of the Contract work.

T. Carefully examine all Drawings and Specifications included under this Contract and Drawings and Specifications included under other contracts and report any discrepancies noticed to the Architect.

U. Due to the small scale of the Drawings, it is not possible to indicate all offsets, fittings, valves, access panels, adapters, and similar parts which may be required. The Drawings are diagrammatic generally indicative of the work to be installed. The Contractor shall carefully investigate the structural and finish conditions affecting the work and arrange all work accordingly, furnishing necessary parts and equipment as may be required to meet the various conditions.

V. The Contractor shall layout his work from dimensions of Architectural and Structural Drawings and actual dimensions of equipment being installed. Layouts in congested areas should not be scaled from Plumbing, HVAC and Electrical Drawings. Clearances shall be provided on all sides of equipment as required for proper maintenance purposes and as required by the Pennsylvania Department of Labor and Industry.

W. The Contractor shall furnish the services of manufacturers' representatives for all equipment furnished under these Contract Documents. The amount of factory service provided by the Contractor shall be as normally recommended and furnished by the various equipment manufacturers unless specified otherwise. Testing of such systems and equipment shall be
made under the direct supervision of competent authorized service representatives. Any and all expenses incurred by the equipment manufacturers' representatives shall be borne by the Contractor.

X. All equipment and materials shall be manufactured in accordance with national standards established by manufacturer's associations, engineering and testing societies, such as NBMA, NEMA, ASTM, AMCA, ASME, ANSI, ACI, FM, U.L., where such standards have been established. The standards shall be construed to mean their correct specifications and designations as amended, as of the date of bid opening.

Y. When the installation is reported in writing by the Contractor to be complete and ready for acceptance, tests and inspection shall be made by the Contractor in the presence of the Architect to ascertain whether it complies with the Specifications and Contract, and upon its failure to do so, the Contractor shall at once remedy all defects and shortcomings and any additional tests that may be required shall be entirely at the Contractor's expense. All of the testing work shall be done when and as directed by the Architect before the system is accepted.

Z. Include any excavation and backfill as required for work included under this Contract, as herein specified. Work shall conform to all applicable federal, state, county, and local regulations governing safety provisions at excavation sites.

AA. The General Contractor will install insulation with vapor barrier in certain areas of the building. Where the building insulation or vapor barrier is broken due to the installation of piping and equipment, the Contractor shall properly repair all insulation and seal all openings with vapor barrier covering and vapor barrier adhesive, of types installed with the insulation.

BB. The Architect reserves the right to revise locations of piping and equipment within the building, as long as sizes remain the same. The Contractor should include suitable allowance in his bid price for the above.

CC. In all cases where equipment and materials are specified in the singular or plural number, it is intended that such reference shall apply to as many such items as are required to complete the installation.

DD. Where piping or other equipment passes through fire or smoke barrier stops, walls, floors, or ceilings, this Contractor shall furnish and install sleeves and shall thoroughly seal openings around sleeves, pipes, and equipment with fire and smoke resistant materials. Materials shall be furnished by the Plumbing Contractor as required to maintain the fire rating of the walls, partitions, ceilings and floors in accordance with the requirements of NFPA, the Pennsylvania Department of Labor and Industry, and other applicable codes.

EE. All moving parts of equipment and appurtenances installed shall be properly lubricated by the Contractor.

FF. The Contractor will be responsible for the completion of all work included under this Contract and shall employ skilled and qualified tradespeople as necessary to satisfy all work and trades.

GG. All capped or plugged connections shall be suitable for permanent, gastight installations.

1.3 CODE COMPLIANCE
A. All plumbing work and materials shall comply with all applicable codes. Energy conservation shall be provided for plumbing systems as described in The International Energy Conservation Code.

1.4 ROUGH-IN

A. This Contractor shall verify roughing-in dimensions for all fixtures and equipment prior to roughing-in for such fixtures and equipment.

1.5 SHOP DRAWINGS

A. This Contractor shall submit prints of shop drawings and manufacturers’ data for approval in the manner prescribed. Refer to this section for “Required Submittals”.

1.6 RESPONSIBILITIES OF BIDDERS

A. Before ordering any material or doing any work, this Contractor shall verify all measurements at the site and shall be responsible for the correctness of same. Any differences encountered between the site measurements and those shown on the Drawings shall be submitted to the Architect for consideration before proceeding with the work.

B. This Contractor is assumed to be skilled in the trade and is solely responsible for compliance with health and safety regulations, performing the work in a safe and competent manner, and installation procedures required for the work as outlined in these documents.

C. This Contract is all-inclusive of the work indicated on the Drawings and herein specified, and no separate Contract work, supplementary labor or service will be provided by the Owner, except as otherwise noted on the Drawings or herein specified.

D. If any part of the installation specified or shown on the Drawings to be executed under this Contract requires a trade or classification of mechanics other than is normally directly employed by this Contractor, it shall be expressly understood that this Contractor shall sublet or engage mechanics experienced in each explicit trade involved to execute the work for the Contractor.

1.7 SCAFFOLDING AND RIGGING

A. This Contractor shall provide all the scaffolding required to do the work included in this Contract. All necessary precautions must be taken in high risk areas. Provide temporary rigging, as required, to install work.

1.8 DRAWINGS

A. The drawings are intended to be diagrammatic and are based on one (1) manufacturer's equipment. They are not intended to show every item in its exact location, the exact dimensions, or all the details of the equipment. The Contractor shall verify the actual dimensions of any substituted materials and equipment to ensure that they will fit in the available space. All apparatus shall be located and all pipes run in the manner and locations shown thereon as closely as conditions will permit, and deviations therefrom shall be made only with the consent of the Architect, and without additional charge to the Owner.
1.9 TEN-DAY PRIOR APPROVAL

A. Any equipment or components proposed for this project, other than model numbers named in the bid documents, shall have pertinent submittal data and descriptive cover sheet submitted to the Architect ten (10) days prior to the bid date for inclusion in an addendum, if and when, reviewed and accepted for bidding.

B. This is for prebid review and is not to be regarded as submittals required for construction.

C. Bidder shall base the bid on items of equipment actually named in bid documents or addendums issued prior to bidding. Verbal acceptance will not be recognized unless verified in writing. It is the Bidders' responsibility to ascertain that all equipment has been accepted by requiring copies of the Architect’s written acceptance from the Equipment Suppliers.

1.10 WARRANTIES

A. The equipment and materials manufacturers are expected to recognize that they are responsible for the failure of their products to perform in accordance with data furnished by them or their authorized representatives as well as misrepresentations of such data. When the products have been installed in accordance with the manufacturer's published or written instructions and recommendations and such products fail, then the Contractor and the manufacturers are responsible for replacement of the products and all associated work and materials without additional cost to the Owner. This warranty applies to all items supplied on the equipment and not just those that are the product of the manufacturer.

B. The Contractors' warranty shall include at least two (2) inspections of the system to repair and replace any items found to be defective during this period. The first shall be approximately six (6) months after the acceptance of the system and the second at the end of the first year.

1.11 SHOP DRAWINGS AND SUBMITTALS

A. Refer to Architect’s Front End for submittal requirements.

B. At the close of the job, prior to final review, five (5) bound copies of operations and maintenance (O&M) manuals shall be submitted by transmittal to the Engineer for review and acceptance. In lieu of hard copy O&M manuals, the Contractor may submit two (2) copies on CD format containing PDF files. O&M manuals, regardless of format, shall include the following:

1. Equipment warranties.
2. Contractors' warranties.
3. Parts list and manuals for all equipment.
4. Operating instructions (in writing).
5. Written instructions on maintenance and care of the systems.
C. Prior to the installation of any equipment or materials, submit shop drawings and manufacturer's data for the items listed in the Submittal Log (Attachment A) in accordance with the Contract Documents. Submittal Log (Attachment A) shall serve as the Contractor’s checklist to assure the complete submission of all required shop drawings and manufacturer’s data. Additionally, all equipment and materials furnished as part of this Contract shall be submitted for review regardless of whether it is listed on Submittal Log (Attachment A) or not.

D. The submissions are the Contractor's documents, and the Architect's and Engineer's review or acceptance constitutes an acknowledgment that the documents have been submitted and nothing more. It is the Contractor's responsibility to check his own submissions for compliance with the Contract Documents and job conditions.

E. Any deviations from the design documents must be clearly identified so that the Engineer may properly review such items. It shall not be the Engineer's responsibility to search out these discrepancies. If such changes are not properly flagged for the Engineer's review, the Contractor shall be completely responsible for all consequences said changes may result in on the project.

F. Submit Record (As-Built) Drawings. Refer to Paragraph 3.03

1.12 UTILITIES AND PROTECTION OF SERVICES

A. Do not interrupt any utility or service without adequate previous notice and schedule.

B. The Contractor shall, at his own expense, repair, replace and maintain in service any utilities, facilities or services (underground, overground, interior or exterior) damaged, broken or otherwise rendered inoperative during the course of construction. The material used by the Contractor shall be approved by the Architect.

C. Refer to “Excavation and Backfill” for site underground utility marking strips.

1.13 INSTRUCTIONS TO OWNER’S OPERATING PERSONNEL

A. The Contractor and his subcontractors shall satisfactorily complete the systems so that they are functional and operating to the satisfaction of the Architect. All systems, their controls and their sequencing must be demonstrated to the satisfaction of the Architect.

B. The Contractor shall furnish the services of qualified personnel, approved by the Architect and thoroughly familiar with the completed installation, to instruct the Owner’s permanent operating personnel in the proper operation of all systems included under this Contract and the proper care of all equipment and apparatus. These services shall be furnished for a period of two (2) 8-hour days after the operation of the building has been taken over by the Owner.

C. When instructions are provided under this Contract, the Contractor shall have in his possession three copies of an identifying letter which shall list the names of the Contractor’s qualified instruction personnel, including manufacturer’s representatives and subcontractors that will be giving instructions. Likewise on the same letter, spaces shall be provided for the Owner’s personnel who will receive the instructions. After instructions have been given and received for each system, the Contractor’s representatives and subcontractors shall sign and date the letter, and the Owner’s personnel shall sign and date the letter acknowledging that they have received adequate instructions for operating and maintaining the systems and equipment. One
signed copy shall be delivered to the Owner, one copy to the Architect, and one copy shall be retained by the Contractor.

D. It is the intent that the entire systems with their complement of equipment and auxiliary equipment operate properly in accordance with the design concept and functional intent. It is also the intent that the Owner be given complete instructions for the proper operation and maintenance of all systems.

PART 2 - PRODUCTS

2.1 GENERAL

A. All products shall be first-line quality, of grade and type shown on the Drawings, and specified or equivalents accepted by the Architect in writing.

B. All products shall be in current production with no notice having been given that this product is to be drastically changed, modified or discontinued from production.

C. The Supplier, by submitting, certifies that the equipment being proposed is proper for the application intended and that it has the capacity called for on the Drawings or in the Specifications.

2.2 COMPLETE SYSTEM

A. All products, materials, and accessories shall be furnished, and installed as required, for a complete system ready for the Owner’s beneficial use.

2.3 EQUIPMENT AND MATERIALS DEVIATIONS

A. When any material or equipment is identified on the drawings or in the Specifications by reference to a manufacturer's name or model number; it is intended to establish a required standard of design and quality; and it is not intended to limit competition.

B. When the Drawings and/or Specifications indicate one or more manufacturers' names for materials or equipment, the Bidder may submit a bid based on materials or equipment of manufacturers not named but considered by the Bidder to be equivalent to the standard of design and quality specified; however, such substitutions must be accepted by the Architect as equivalent. If the Bidder elects to bid on a substitution without securing written consent of the Architect prior to receipt of the bids, then it will be understood that proof of compliance with the specified requirements is the direct responsibility of the Bidder, and no such materials or equipment may be purchased or installed without written acceptance.

C. Bidders are advised to ascertain such acceptance from their Suppliers by requesting copies of acceptance in writing signed by the Architect from their Suppliers.

D. Where the equipment’s electrical characteristics (i.e. horsepower, wattage, voltage, amperage draw, etc.) deviate from the plumbing and/or the electrical design, it is the responsibility of the Plumbing Contractor to strictly coordinate all electrical requirements prior to submittal, to meet the specific electrical requirements without a change order. Confirmation of coordination shall be included with the appropriate submittal. No change orders shall be awarded due to lack of coordination between trades.
2.4 TAMPERPROOF SCREWS

A. All screws exposed to view on plumbing equipment installed under this Contract, such as on wall access panels, fixtures and trim, floor drains, cleanouts, water coolers, and similar equipment, shall be tamperproof type. Screws shall be vandalproof slot type, Holt head, Allen head, or similar types. Phillips head screws are not regarded as tamperproof.

B. Finish of screws shall match the finish of equipment in which they are being installed.

2.5 ACCESS PANELS

A. The Plumbing Contractor shall furnish factory-fabricated access panels for access to all concealed valves, shock absorbers, air vents, traps, trap primers, strainers, cleanouts, plumbing equipment, fire protection equipment, and other items where no other means of access is available. Access panels shall be of appropriate size but not less than 18", except as otherwise noted on the drawings, flush type, hinged to drop down and out, concealed hinge and vandalproof operated spanner head cam lock, stainless steel in tile work and prime coated sheet steel in plaster or acoustical tile of all types. The Plumbing Contractor shall deliver access panels to the General Contractor for installation. Exact locations of panels shall be determined by the Plumbing Contractor, but panels shall be located for a symmetrical appearance. Access panels are not required at lift-out removable tile ceilings.

B. At locations where indirect waste access is required, access panel doors shall be louvered. Louvered panel doors shall be as manufactured by Cierra Products, or approved equivalent.

C. At locations where access panels are installed in fire-rated construction, access panels shall contain the 1-1/2 hour fire-rated "B" label; and in addition, shall also be provided with layers of gypsum wall board in thicknesses which will supply additional fire ratings equal to the fire ratings of adjacent construction.

D. Coordinate with the General Contractor on fire ratings of construction.

2.6 SLEEVES AND ESCUTCHEONS

A. The Contractor shall provide sleeves for all piping and equipment passing through walls, floors and foundations. Sleeves, in general, shall be constructed of Schedule 40 steel pipe. Space between pipe and sleeve shall be sealed with a fire stopping material. Sleeves are not required for vertical core-drilled holes (i.e. fixture drainage piping); however, openings shall be filled with firestopping. Sleeves for large sewer piping which may pass through grade beams shall be Schedule 40 PVC. Provide openings through grade beams in accordance with Architect’s requirements.

B. All sleeves shall be of sufficient size to allow continuous passage of insulation where required.

C. Where pipe motion, due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of pipe.

D. Sleeve installations in exterior and designated interior walls, foundations and slab on grade floors shall consist of steel sleeves with the annular space between the carrier pipe and sleeve continuously filled with modular, mechanical type, inter-locking synthetic rubber links.
Sleeves shall be Model WS and links, Model LS, all as manufactured by LINK-SEAL Division, Thunderline Corporation, Advance Products & Systems, Inc., or Metraflex.

E. Sleeves through fire rated construction shall be sealed as specified under the "Fire Stopping" section of this Specification.

F. Escutcheons, including at fixtures, floor, wall, and ceiling plates, shall be chrome, cast brass, setscrew type. Provide “deep type” escutcheons where required to conceal connections; use split ring backup escutcheons beneath deep escutcheons for extra depth where necessary. For insulated pipes, the escutcheon shall surround the outside of the insulation.

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. All work shall be performed by competent mechanics using proper tools and equipment to produce first-quality work. All work shall be neatly installed, accessible for maintenance, and complete with all accessories required.

3.2 ACCESSIBILITY

A. All equipment shall be installed in such away that all components requiring access (control operators, motors, drives, belts, valves, etc.) are so located and installed that they may be serviced, reset, replaced or recalibrated, etc. by service people with normal service tools and equipment. If any equipment or components are shown in such a position that this Contractor cannot comply with the above, the Contractor shall notify the Architect.

3.3 RECORD (AS-BUILT) DRAWINGS

A. The Contractor shall maintain a complete set of Contract Drawings at the site and shall record all deviations in his work (in red ink or pencil) from that indicated on the Contract Drawings. Deviations shall be clearly and accurately recorded so that the Engineer can prepare final record (as-built) drawings using the Contractor’s marked-up drawings. Dimensions shall be recorded using permanent reference points such as columns, building walls and like items. These record drawings shall be submitted to the Architect prior to final acceptance.

3.4 CODES, STANDARDS, AND REGULATIONS

A. All materials and workmanship shall comply with all applicable codes, federal and state laws, Specifications, local and county codes and ordinances, industry standards, utility company regulations, NFPA, and NEC. In case of a difference between codes, Specifications, federal and state laws, local and county codes and ordinances, industry standards, utility company regulations, NFPA, and NEC, and the Contract documents, the most stringent shall govern. The Contractor shall promptly notify the Architect in writing of any such difference.

B. Reference to the following codes shall mean:

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<th>REFERENCE</th>
<th>DEFINITION</th>
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<tr>
<td>ASTM</td>
<td>American Society for Testing Materials</td>
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<tr>
<td>UL</td>
<td>Underwriters Laboratories, Inc.</td>
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C. Should the Contractor perform any work that does not comply within the requirements of the applicable building codes, state laws and federal laws, local and county codes and ordinances, industry standards, utility company regulations, NFPA, and NEC, the Contractor shall bear all costs arising in correcting the deficiencies.

D. This Contractor is assumed to be skilled in the trade and is solely responsible for compliance with OSHA regulations, performing the work in a safe and competent manner, and in installation procedures required for this work. All supervision assigned to this project shall be experienced in this type of work. This Contractor’s superintendent shall be designated as Safety Inspector, unless the Contractor designates another person and notifies the Architect of this change.

3.5 REVIEW BY ARCHITECT

A. This Contractor shall notify the Architect at the following stages of construction so that the Architect may visit the site for review and consultation:

1. When equipment installation starts.
2. When ceiling installation will cover any work not reviewed.
3. When any piping is to be permanently concealed by construction.
4. When any piping is to be permanently concealed by backfilling of trenches.
5. When testing is started.

B. Should the Contractor fail to notify the Architect at the times prescribed above, it shall then be the Contractor’s responsibility and cost to expose any concealed piping or demonstrate the acceptability of any part of the system. Any extra cost, caused by the removal of work by other trades, shall be borne by this Contractor, at no cost to the Owner.

3.6 EARLY START-UP

A. This Contractor shall do all possible to see that the plumbing **and fire protection** equipment is connected with electrical power as early as possible, so that final testing can be started. Should this Contractor be ready for operation and power is not available, the Electrical Contractor and the Architect shall be notified.

3.7 CLEANING AND PAINTING

A. At the completion of the project, thoroughly clean all equipment and remove all trash, cartons, and similar debris from the area. Make any necessary corrections or repair/replace any damaged materials or equipment. Leave the entire systems in a thoroughly clean and orderly manner.
B. Where welding of pipe destroys factory pipe coating, piping shall be repainted. Any finished surfaces that have been scratched or discolored shall be touched up or repainted with paint to match the original color, to the satisfaction of the Architect. If any part has been bent, broken or otherwise damaged, it shall be replaced new prior to final review.

C. The following items of equipment and piping being furnished under this Contract shall be prime coated and finish painted by the Plumbing Contractor. Painting shall be in strict accordance with the requirements and recommendations of OSHA.

1. All equipment and piping installed outside the building exposed to weather, including on roof areas. Colors shall be as selected by the Architect. Finish paint cast iron roof drains of color selected by the Architect.

2. All non-galvanized and unpainted support steel, brackets, hangers, and other miscellaneous metals, including in crawl spaces, tunnels, walkways, above ceilings, loft spaces, prefabricated floor trenches, mezzanine spaces, and accessible pipe spaces.

D. Insulated piping is not required to be painted, unless requirements provided by the Owner and Architect. All Piping shall be painted in accordance with Owner and Architect requirements. Coordinate painting procedures and requirements prior to bidding. Painting of piping may include, but not limited to, the following:

1. All insulated piping and equipment exposed to public view.

2. All uninsulated piping in Mechanical Equipment Rooms.

E. Surfaces required to be finished painted shall be painted as follows:

1. All uninsulated piping shall be painted with one (1) coat of rust inhibitive red primer and one (1) coat of gloss enamel.

2. All other ferrous metals shall be painted with one (1) prime coat of equipment and machinery primer and one (1) finish coat of gloss enamel.

3. Coated cast iron or coated black steel piping need not be painted above ceilings; however, rusted or scraped piping shall be touched up, to keep a like new finish.

4. All galvanized surfaces shall be painted with one (1) prime coat of galvanized steel primer and one (1) finish coat of gloss enamel. All aluminum surfaces shall be painted one (1) prime coat of aluminum primer and one (1) finish coat of gloss enamel. Paint shall be of types specifically made for these surfaces.

5. All other copper and brass surfaces shall be painted with one (1) prime coat of zinc chromate primer and one (1) finish coat of gloss enamel.

F. Color code and/or label all natural gas piping per Gas Company’s and/or Owner/Architect’s requirements.

G. Paint shall be of colors selected by the Architect.
H. Finish paint color samples shall be submitted to the Architect for approval.

I. Paint shall be as manufactured by Glidden, PPG, Rust-Oleum, or Sherwin-Williams.

J. All painting shall be done in a careful, neat and workmanlike manner with particular care being exercised to protect building equipment and finishes. All surfaces shall be thoroughly cleaned of rust, scale, dirt, grease, dust, and like items, and sanded so as to provide bond for new paint. The Contractor shall be entirely responsible for cleaning all surfaces and should evidence appear to the Architect that the surface was not properly prepared, the Contractor shall remove paint, prepare surface and repaint as required at no additional cost.

K. The Contractor shall be responsible for painting his piping and equipment installed in finished areas after these areas have received finish painting by the General Contractor or in areas where the General Contractor is not painting.

L. Refer to “Plumbing Identification”, Section 220553, for stenciling and labeling.

M. Color code and/or label all LP gas piping per Gas Supplier’s requirements.

3.8 FINAL CONNECTIONS

A. All equipment noted as furnished and installed by other contractors or by the Owner that require plumbing services will be furnished and installed complete with trim by that party, except as herein specified. The Plumbing Contractor shall coordinate type and location of equipment, rough-in services noted or required and make final connections. Final connections shall include items such as drain tailpieces, “P”-traps, running traps, water, air, and gas shut-offs, interconnecting piping extensions, piping within and around cabinetry, combination waste assemblies where required, piping adapters, and like items.

3.9 MAINTENANCE

A. Contractor shall be responsible for maintenance of all equipment and apparatus included under this Contract until final project completion.

3.10 PLUMBING PLANS

A. The plumbing plans are intended to be diagrammatic and are based on one (1) manufacturer’s equipment. They are not intended to show every item in its exact location, the exact dimensions, or all the details of the equipment. The Contractor shall verify the actual dimensions of any specified or substituted materials and equipment to ensure that they will fit in the available space. All apparatus shall be located as closely as conditions will permit and deviations therefrom shall be made only with the consent of the Architect and without additional charge to the Owner. The right is reserved by the Architect to make any reasonable changes in the location of the equipment prior to rough-in without invoking additional expense to the Owner.

3.11 QUESTIONS AND CLARIFICATIONS OF BID DOCUMENTS

A. Bidders shall not rely on any verbal clarification of the drawings and specifications. Any questions or clarifications shall be referred to Engineer at least seven (7) working days prior to bidding to allow for issuance of an addendum.
3.12 CHANGE ORDERS

A. If change orders are not justified or rejected repeatedly by the Architect and the Owner, the Contractor shall be required to reimburse the Architect and the Engineer for time spent in excess of eight (8) hours to review change orders that are not justified.

3.13 SUBSTITUTIONS

A. Throughout the Specifications, types of materials may be specified by manufacturer's name and catalog number in order to establish standards of quality and performance and not for the purpose of limiting competition. Unless specifically stated otherwise, the bidder may assume the phrase "or approved equivalent," except that the burden is upon the bidder to prove such equality. If the bidder elects to prove such equality, he must request the Architect's approval in writing to substitute such item for the specified item, and shall submit supporting data, and samples if required, to permit a fair evaluation of the proposed substitution with respect to quality, serviceability and warranty. All data pertinent to the proposed substitution shall be submitted to the Architect at least 10 days prior to the bid date for evaluation and review purposes. If the Architect accepts the proposed substitution, an addendum will be issued to all bidders advising all bidders that this substitution will be acceptable from all bidders.

B. Substitutions of equipment other than that specified must be very carefully checked to assure that no problems will occur due to dimensional differences, code requirements, connection points, weights, etc. Where the Contractor elects to substitute materials or equipment approved by the Architect for those specified, the Contractor will be held responsible for all architectural, structural, mechanical, and electrical changes required for the installation of the substituted materials at no additional cost to the Owner. All tests required to substantiate the equivalence of the material will be the obligation of the Contractor.

C. When this Contractor desires to furnish equipment of a manufacturer other than that specified or intended, he shall include a complete specification of the substituted item, along with each submission copy of shop drawings, indicating the necessary modifications to the substituted product to satisfy the requirements of the Contract Specifications. Manufacturer's specifications shall be written as close as possible over the Contract Specifications and each paragraph shall bear the same paragraph number as the Contract Specifications so that close comparison can be made. All submissions will be rejected should they not include the comparison specification. Comparison specification shall be submitted for approval 10 days prior to the Bid Date. If prior approval is not obtained, no substitutions will be considered and the Engineer reimbursed for time spent to reject and return such submission.

D. The verification specification shall include the exact wording of the Contract Specification and the revised wording identified properly indicating all the deviations proposed. If no deviations are noted, the Contractor must furnish the material or equipment in accordance with the Contract Specifications.

E. Should the Contractor elect to propose a substitution after the project has been awarded, the Contractor will be billed for the time spent by the Architect and his consultants in evaluating the proposed substitution. This billing shall occur whether the proposed substitution is accepted or rejected and shall be at the rate of the direct cost to the Architect times a 2.5 multiplier.
F. The submissions are the Contractor's documents, and the Architect's and Engineer's approval constitutes an acknowledgment that the documents have been submitted and nothing more. It is the Contractor's responsibility to check his own submissions for compliance with the Contract Documents and job conditions.

3.14 COORDINATION FOR CONTRACTORS

A. The Contractor must arrange work to eliminate conflicts with work of other contractors. It is extremely important that fire protection piping not be installed unless directly coordinated with the HVAC Contractor’s ductwork installations and other contractor’s piping and equipment installations.

B. Actual location of pipe and equipment shall be determined at site. In general, routings of the HVAC Contractor shall take precedence. Contractor shall confer with other contractors as to locations of pipes, ducts, electrical and equipment provided under their contracts, before erecting any work. In case of confliction, the Architect shall have the final decision, with no cost to Owner.

C. Contractor shall furnish Electrical Contractor information on electrical requirements of equipment provided under Contract. Equipment connections shall be made in neat and workmanlike manner, placing equipment in proper operating condition, with provisions for maintenance or replacement. Equipment manufacturer's recommendations shall be followed for final connections.

3.15 EXCAVATION AND BACKFILL

A. The excavation shall be unclassified. All excavation shall mean the removal of all materials necessary to obtain proper grade for all piping and work installed under the Contract.

B. Unless noted otherwise in these Specifications, trenching shall be excavated 6" below pipe invert and backfilled with thoroughly mechanically tamped crushed stone having a maximum size of 1/2". After the work has been inspected and/or tested, the excavation shall be backfilled around and up to 12" over the pipes with the same material as pipe bedding. The balance of the excavation/trenching shall be backfilled as follows:

1. Interior Areas – Backfill shall be 2RC stone up to the level of the pavement stone base.

2. In all cases, backfill shall be thoroughly mechanically tamped and placed in layers not exceeding 6" in depth. Compact each lift until a dry density is obtained, which is equal to or exceeds 95% "Proctor" for pavement areas and building slab on grade areas; 90% "Proctor" elsewhere. Maximum dry density shall be obtained by testing a representative sample of fill in accordance with ASTM D-1557. Submit laboratory test reports which shall indicate compliance with these Specifications. Tests shall be performed at the following locations and frequencies, or as otherwise directed by the Architect:

   a. Paved and building slab on grade areas: In no case fewer than three (3) tests- at subgrade and at two (2) selected compacted fill and backfill layers.

   b. Foundation wall backfill: In no case fewer than two (2) tests – at compacted initial and final backfill layers.
c. Trench backfill: In no case fewer than two (2) tests-at compacted initial and final backfill layers, at least one test for each 150 feet or less of trench length.

3. Special excavation and backfilling will be required for underground acid piping systems. Refer to Sections (221300) and (221415).

4. For underground gas service piping, included under this Contract, interior, exterior, furnish and install 6" of fine, clean, unfrozen, natural river sand all around piping—under, along side of, and on top of piping. Backfill to grade as specified herein.

5. Provide a 6" wide detectable metallic caution type foil marking strip for each exterior underground utility line installed under this Contract, continuously, all locations. Marking strip shall be a minimum of 12" below finished grade, except 6" below subgrade under pavements and slabs; color coded, with appropriate applicable wording. Marking strip shall be as manufactured by Seton Name Plate Company, Brady Co., or MSI Services. Marking strip shall be placed before finished grading procedures and shall be directly coordinated with site utility marking strips provided by others.

   a. Provide above marking strip over outside edges of the underground grease interceptor vault, underground acid neutralizing tank containment basin, and similar locations.

C. The excavation shall be kept free of water. No piping, equipment or concrete shall be installed in water. The Contractor shall provide necessary pumping and drainage for the protection of the installation.

D. All excavation or trenching which occurs under wall foundations shall be backfilled up to the level of the wall foundation using concrete as herein specified.

E. Where ground is found to be unsuitable to support pipe, provide concrete cradles. When laying pipe in concrete cradles, deposit concrete full width of cradle continuously to bottom of pipe, before concrete is set, embed pipe evenly, deposit remainder of concrete and tamp in a manner to avoid disturbing pipe. Provide concrete bridging in trenches in roadways in strict accordance with utility company or sewer authority requirements.

F. Any information on utilities, surface or sub-surface structures, roadways, piping or conditions presented on the contract drawings does not guarantee that these utilities, surface or sub-surface structures, roadways, piping or conditions shall be exactly as illustrated and described. It is the Contractor's responsibility to obtain and/or verify such information prior to construction in order that he may provide an installation in complete conformity with design intent of the project.

G. The Contractor shall maintain the work safe to human life and property in conformance with all Local, County, State and Federal Safety Regulations.

H. Any structures and existing services damaged in the course of the work shall be repaired by the Contractor in kind equal to or surpassing the existing installation.

I. For all exterior plumbing site work in public highway, street, or right-of-way, it is the Plumbing Contractor's responsibility. The Contractor shall make all necessary arrangements with appropriate governing or municipal agency, make repairs, provide concrete, obtain and pay for
all permits, inspection fees, tapping fees, obtain approvals and all other incidental costs of work, relative to work under this Contract. Include the use of flag persons for continuous movement of traffic in roadways.

J. All excess excavation material shall be removed from the site, properly and legally disposed of, at an approved land fill area, unless arrangements are made with the Owner for on-site disposal.

K. For all exterior plumbing site work included under this Contract, the Plumbing Contractor shall restore and/or replace all paving, sod, turf, sidewalks, roadways, driveways, road base courses to match existing, shrubs, gutters or other disturbed surfaces to a condition equal to, or surpassing that before the work began and to the satisfaction of the Architect and the Owner and shall furnish all labor and material incidental thereto. Include all necessary raking, seeding, and fertilizing.

3.16 SPECIAL ENGINEERING SERVICES

A. In the instance of Mechanical and Control systems, such as all major and special equipment, controls, or similar miscellaneous systems and equipment, the installations, final connections and testing of such systems shall be made under the direct supervision of competent authorized service engineers who shall be employed by the respective equipment manufacturer and/or an authorized representative. Any and all expenses incurred by these equipment manufacturers' representatives shall be borne by the Contractor.

3.17 TESTS AND ADJUSTMENTS - GENERAL REQUIREMENTS

A. The Contractor shall furnish all labor, material, and equipment necessary for performance of all tests required by any of the agencies having jurisdiction. Testing procedures shall be outlined hereinafter under the respective sections of these specifications.

B. All tests shall be conducted in the presence of the Architect. No piping shall be concealed until the system has been approved.

C. At the completion of the work, all equipment, valves, fixtures, fixture trim, mixing valves, regulators, hose bibbs, wall hydrants, sprinkler heads, etc., shall be adjusted for proper operation.

D. The Contractor shall obtain certificates of approval, acceptance and compliance with regulations of all agencies having jurisdiction. Work shall not be deemed complete until such certificates have been delivered to the Architect.

3.18 CONCRETE WORK

A. Furnish and install all concrete work related to work included under this Contract. Construct concrete forms and bases for the equipment installed under this Contract. Bases and forms shall be of suitable dimensions for all equipment. All concrete work shall be constructed subject to the approval of the Architect.

B. Bases shall be reinforced with 6 x 6 x #10 gauge wire mesh unless detailed otherwise and anchored through floor construction with 3/4" diameter bolts or rods. Anchor bolts for equipment shall be placed in base before equipment is set.
C. Concrete shall attain a minimum compressive strength of 3,300 psi at the age of 28 days, unless otherwise specified or indicated on the Drawings, such as for manufacturer’s precast concrete construction. Tests shall be made by an approved laboratory if in the opinion of the Architect the concrete is not satisfactory. All costs in connection with tests of concrete shall be borne by the Contractor.

D. All materials used for plain and reinforced concrete and the measuring, mixing, handling, placing and curing shall conform to current specifications of the American Concrete Institute (ACI 304 and ACI 318-71). Cement shall be normal Portland cement, Type I or Type II, conforming to ASTM Designation C-150.

E. Aggregates shall consist of sand of approved quality, crushed stone, and washed gravel conforming to ASTM Standard Specification Designation C-33, and shall be supplied from a source approved by the Architect. The maximum size of the aggregate shall be no larger than 1/5 of the narrowest dimensions between forms of the members for which the concrete is to be used, no larger than 3/4 of the minimum clear spacing between reinforcing bars. All water for concrete shall be clean and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

F. Slag in any form will not be permitted as an aggregate.

G. Proportions shall be in accordance with American Concrete Institute Standard "Recommended Practice for the Design of Concrete Mixes ACI 211.1."

H. Metal reinforcement shall be deformed steel bars, cold-drawn steel wire, or fabricated forms of these materials. All bars shall be deformed, intermediate grade new billet steel. These materials shall conform in quality to Standard Specifications of the American Society for Testing Materials of the following applicable titles and serial designations:

**Bars**

Billet-Steel Bars for Concrete Reinforcement\________\__________\________A 615
Rail-Steel Bars for Concrete Reinforcement\________\__________\________A 616

**Wire**

Cold Drawn Steel Wire for Concrete Reinforcement\________\__________\________A 82

**Fabricated Materials**

Fabricated Steel Bar Mats for Concrete Reinforcement\________\__________\________A 184
Welded Steel Wire Fabric for Concrete Reinforcement\________\__________\________A 185

I. Forms shall be of steel or wood and shall conform to the shape, piping, grades and dimensions of the concrete. All formwork shall comply with ACI 347. They shall be sufficiently tight to prevent leakage of mortar and shall be properly braced and tied together so as to maintain the desired position and shape during and after placing concrete. Forms shall be removed in such a manner as to assure the complete safety of the structure. All exposed corners or edges shall be chamfered. All burrs, fins, irregularities of forming, or spillage shall be removed and the surface float or trowel finished to a smooth straight surface.
J. Concrete shall be integrally waterproofed with Rez-Seal, by Euclid Chemical Company, or approved equivalent additive.

K. Water stops of plastic, as manufactured by Ryerson, or approved equivalent, shall be installed in all concrete joints and between pours.

L. Any new piping routed below new or existing foundations shall be encased in concrete. Concrete shall extend a minimum as follows: to the underside of the foundation wall, on 1’-0” on each side of the interior and exterior foundation walls, and 1’-0” below the pipe. Concrete below piping shall be set on 2’-0” of 2RC, or equivalent, stone base.

3.19 COORDINATION DRAWINGS

A. Coordination

1. Each Contractor shall familiarize himself with the drawings and specifications of all other contracts relating to this project and shall coordinate with, and be held responsible for his Work which is affected by or dependent on, other contracts.

2. Each Contractor shall provide any dimension, coordination, sleeve, insert, embedded or built-in item, and/or information which is required to be built into, or to complete, the work of another contract in a manner consistent with the Approved Project Schedule. Any additional cost or delay damages arising from a contractor’s failure to so furnish or provide shall be borne by that contractor.

B. Coordination Drawings and Procedures

1. Each Contractor shall prepare composite shop drawings and field installation layouts for his work as directed by the Architect to solve tight field conditions except as modified in Paragraph 3 below. Such drawings shall consist of dimensioned plans and elevations and shall give complete information, particularly to size and location of sleeves, attachments, openings, conduits, ducts, boxes and structural interferences.

2. These composite shop drawings and field installation layouts shall be coordinated in the field among the Contractors to verify the proper relationship to the work of other Contractors based on field conditions, and shall be checked for accuracy and approved by the Contractors as directed by the Architect before submission to the Architect for final approval.

3. HVAC, Plumbing, Fire Protection and Electrical Work shall be coordinated as indicated by the following procedure. Each Contractor shall sign each coordination drawing after all work has been laid out and conflicts resolved. The preparation of coordination drawings and layout Work on the coordination drawings shall be performed at the site by each Contractor.

   a. The HVAC Contractor shall prepare a drawing of each area, at a scale of 1/4 inch equal 1’-0”, showing his work plan and elevation. The Architect/Engineer can provide CAD Backgrounds of the entire project to the HVAC Contractor for his use. The HVAC Contractor shall layout and show light fixtures on the drawings.
b. The drawings referred to in 3. a. above shall then be forwarded to the next succeeding Contractor for layout of their work in the field in the following order: (a) PLUMBING (b) FIRE PROTECTION; (c) ELECTRICAL; (d) INTERIOR CONSTRUCTION.

c. By use of color coding, each succeeding Contractor shall show his work on the referenced drawings and shall sign same to indicate his satisfaction that there is no interference between his work and that of other Contractors. Colors will be assigned by the Architect.

d. When all work has been shown and signed off, the HVAC Contractor shall forward each to the Architect for review and approval. Prints of approved transparencies shall be distributed to the Contractors by the Architect.

e. The Architect shall print one copy for each trade for use in the field.

f. The color coded drawings shall be kept at the Architect’s field office for future reference in the event of conflict between the trades. At the completion of the project, all color coded drawings shall be delivered to the Owner for his records.

C. Meetings

1. Coordination meetings to resolve interferences in the Work will be held at the site in an area to be provided by the Architect. Representatives of each Contractor shall be present at each meeting. Each Contractor shall provide all necessary resources to insure that the coordination process described herein does not delay the Approved Project Schedule.

D. Each Contractor acknowledges that there may be items of Work which have not been drawn, coordinated, clarified or specified with complete detail in the Contract Documents but which are required for the completion of the Work, as inferable from the Contractor Documents. Any such item, when identified as part of the development of the Work, shall be drawn, coordinated, clarified or specified by the Architect in a manner consistent with contemplated kind, quality and customary standards and provided to the Contractor. When such drawing, coordination, clarification or specification is approved by the Owner, the drawing, coordination, clarification or specification so approved shall thereupon be part of the Contract Documents and the item of Work shall be performed by the Contractor as part of the Work without further action or order of the Owner and without any increase in the Contract amount or time as if such drawing, coordination, clarification or specification were originally included in the Contract Documents.

3.20 COORDINATION DRAWINGS – UNDERGROUND WORK

A. Prior to the start of construction, this Contractor shall prepare and submit to the Architect a complete set of reproducible drawings indicating the routings, sizes, and invert elevations of all underground plumbing piping and fire protection piping crossing through, under, above, and/or otherwise affecting subsurface footings and grade beams.

B. Drawings shall be prepared in the same scale as the Architectural structural plans, and shall illustrate all relevant foundation and underground plumbing piping and fire protection piping.

C. Elevations and subsurface foundation crossings indicated on the Plumbing Contract Drawings are intended to assist the Contractor in developing his Bid Proposal. Specific dimensions,
sleeve sizes where applicable, and elevations shall be determined by the Contractor shown on his Coordination Drawings.

3.21 ACOUSTIC SEALING

A. Seal openings of acoustic-rated ceilings, walls, floors, or other construction, or acoustic area separation requirements with a material or product specially made for these types of applications. Acoustical sealants shall be as manufactured by Arcat, Inc., Acoustical Surfaces, Inc., or American Acoustical Products. Refer to Architectural Drawings for acoustic sealing locations required.

3.22 CLEARANCE REQUIREMENT

A. Ceiling areas directly below heating equipment must be kept clear of all piping, conduit, and other utilities, including fire protection components, to allow for unit access for servicing and/or removal. Refer to “Contractor’s Specific Note” shown on the drawings.

END OF SECTION
# Submittal Log (Attachment A)

**Project Name:**

________________________________________________________________________

**CJL Project No.**: ______________________  **Trade**: ______________________

**Engineer’s Review:**  A = Reviewed, B = Rejected, C = Furnish as Corrected, D = Comments Attached

**Contractor’s Required Response:**  E = Confirm, F = Resubmit

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# Submittal Log (Attachment A)

**Project Name:** 

**CJL Project No.:** ___________________  **Trade:** ___________________

**Engineer’s Review:**  
A = Reviewed, B = Rejected, C = Furnish as Corrected, D = Comments Attached

**Contractor’s Required Response:**  
E = Confirm, F = Resubmit

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<tr>
<td>15160 – 221413</td>
<td>Downspout Boots</td>
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<td>15160 – 221413</td>
<td>Secondary Drain Termination w/ splashblocks</td>
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<td>15160 – 221413</td>
<td>Foundation Drainage Pipe and Fittings</td>
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<td>15160 – 221413</td>
<td>Condensate Vertical Check Valve</td>
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<td>15190 – 221125</td>
<td>Pool Piping, Fitting and Valves</td>
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<tr>
<td>15191 – 221124</td>
<td>Natural Gas Piping and Fittings</td>
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<tr>
<td>15191 – 221124</td>
<td>Natural Gas Valves</td>
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<tr>
<td>15191 – 221124</td>
<td>Natural Gas Regulators</td>
</tr>
<tr>
<td>15191 – 221124</td>
<td>Kitchen Solenoid Valve</td>
</tr>
<tr>
<td>15191 – 221124</td>
<td>Science Room Emergency Shut-Down System</td>
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</table>
### Submittal Log (Attachment A)

**Project Name:**

**CJL Project No.:**

**Trade:**

**Engineer’s Review:** A = Reviewed, B = Rejected, C = Furnish as Corrected, D = Comments Attached

**Contractor’s Required Response:** E = Confirm, F = Resubmit

<table>
<thead>
<tr>
<th>Item Code</th>
<th>Description</th>
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<tr>
<td>15211 – 221416</td>
<td>Air Compressor</td>
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<td>15211 – 221416</td>
<td>Compressed Air Piping and Fittings</td>
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<tr>
<td>15211 – 221416</td>
<td>Compressed Air Outlets</td>
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<tr>
<td>15211 – 221416</td>
<td>Compressed Air Valves</td>
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<td>Compressed Air Hose Reels</td>
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<td>15220 – 221415</td>
<td>Acid Drainage Pipe and Fittings</td>
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<tr>
<td>15220 – 221415</td>
<td>Acid Drains of all types</td>
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<td>15220 – 221415</td>
<td>Cleanouts of all types</td>
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<td>15220 – 221415</td>
<td>Acid Neutralizing Tanks</td>
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<tr>
<td>15300 – 221420</td>
<td>Complete Fire Protection System</td>
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<tr>
<td>15400 – 224000</td>
<td>Plumbing Fixtures and Trim – Complete</td>
</tr>
<tr>
<td>15440 – 221429</td>
<td>Hot Water Circulating Pumps</td>
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<tr>
<td>15440 – 221429</td>
<td>Sump Pumps with Controls</td>
</tr>
<tr>
<td>15440 – 221429</td>
<td>Domestic Water Booster Pump System</td>
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<tr>
<td>15440 – 221429</td>
<td>Sewage Ejector with Controls</td>
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<td>15440 – 221429</td>
<td>Domestic Water Well Pump &amp; Storage Tank</td>
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<tr>
<td>15480 – 223300</td>
<td>Domestic Water Heating Boiler with Storage Tank</td>
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<td>15480 – 223300</td>
<td>Domestic Water Heaters &amp; Accessories</td>
</tr>
<tr>
<td>15555 – 226313</td>
<td>Medical Air Compressor</td>
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Submittal Log (Attachment A)

Project Name: ____________________________________________________________

CJL Project No.: ____________________ Trade: __________________________________

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<td>15555 – 226313</td>
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<td>Medical Gas Manifolds</td>
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<tr>
<td>15555 – 226313</td>
<td>Medical Gas Pipe and Fittings</td>
</tr>
<tr>
<td>15555 – 226313</td>
<td>Medical Gas Valves</td>
</tr>
<tr>
<td>15555 – 226313</td>
<td>Medical Gas Outlets</td>
</tr>
<tr>
<td>15555 – 226313</td>
<td>Medical Gas Zone Valve Boxes and Alarm Panels</td>
</tr>
<tr>
<td>15998 – 226408</td>
<td>Seismic Requirements</td>
</tr>
</tbody>
</table>
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SCOPE

A. The valves for the domestic water systems shall be as hereinafter described in this section.

B. Lead Free: Refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content ≤ 0.25% per Safe Drinking Water Act as amended January 4th 2011 Section 1417. Valve requirements to meet all State and Local requirements.

1.3 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
   1. ASME B16.10 for ferrous valve dimensions.
   2. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF/ANSI 61 and/or NSF/ANSI 372 for valve materials for potable-water service. Valves for domestic water must be 3rd Party Certified.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads.

B. Use the following precautions during storage:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS
2.1 GENERAL USE VALVES

A. The domestic water supply system shall be fitted with valves at points specified or indicated on the Drawings. Provide minimum 3/4” hose end drain ball valves with vacuum breakers and threaded caps at all low points of the water system to provide for drainage.

B. Lead Free silicon bronze (ASTM listed) valves shall be made with corrosion-resistant materials. Manufacturer shall provide third party certification tested in accordance with EN ISO 6509 regarding dezincification corrosion resistance and stress corrosion cracking.

C. Valves 2” and smaller shall be Bronze Valves, ball type, with threaded or solder ends, unless otherwise indicated.

D. All valves for general use shall be Nibco Inc., Hammond, Milwaukee, Apollo, Stockham, Zurn, Wilkins, or Watts. All valves shall be designated for a minimum 125 pounds per square inch (S.W.P.), 200 pounds per square inch (W.O.G.).

E. The name or trademark of the manufacturer and the guaranteed working pressure shall be cast or stamped on the body, as well as ‘Lead Free’ marked handle.

F. Valves in Insulated Piping: With 2-inch stem extensions:
   
   1. Ball Valves: With extended operating handle of non-thermal-conductive material that meets UL 2043 approved for inside air plenum, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.
      
      a. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO NIB-SEAL (-NS suffix in figure no.), handle extension or approved equal.

G. Bronze Ball Valves

   1. Two piece, full port, silicon bronze ball valves with the capability of accepting extended operating handles. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model T/S/PC-585-80-LF (-NS).
      
      a. Standard: MSS SP-110 and ASME A1124.14
      b. CWP Rating: 600 psig
      c. Body Design: Two piece bronze with threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing.
      d. Body Material: Silicon bronze (ASTM Listed), corrosion resistant.
      e. Ends: Threaded, soldered or pressed.
      f. Seats: Reinforced PTFE or TFE.
      g. Ball & Stem: Silicon Bronze ‘Lead Free’ Material
h. Port: Full.

2.2 STOPs

A. Each plumbing fixture furnished under this Contract and each piece of special equipment furnished under other contracts or by the Owner shall, unless otherwise shown or specified, be provided with compression stop valves on the water supply piping. On copper piping, ball valves shall be installed on branch water piping to equipment. Stops shall be finished brass, chrome-plated where exposed and shall be provided with stop control as shown or specified.

PART 3 – EXECUTION

3.1 INSTALLATION

A. All valves must be accessible.

B. Provide a shutoff valve at the base of upfed water risers and at the top of downfed water risers with a minimum 3/4” hose end ball drain valve with vacuum breaker and threaded cap at the base of all water risers.

C. Upon installation, all testable backflow preventers shall be tested under the Plumbing Contract, in accordance with manufacturer’s installation standards, or in accordance with local authorities or utility company having jurisdiction over the installations. All testing shall be completed by persons certified in this type of work. All costs, fees, or charges required for testing shall be included in the Contract price.

END OF SECTION
SECTION 220529 – PLUMBING HANGERS AND SUPPORTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SCOPE

A. The hangers and supports for the various plumbing systems shall be as hereinafter described in this section.

B. Hangers and supports shall be arranged to distribute the weight of the piping and equipment uniformly on the building structure.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. All pipe hangers, riser clamps, and supports shall be as manufactured by The Modern Pipe Supports Corp., Anvil International, Inc., Tolco Co., or Erico Corp. The following catalog numbers are taken from The Modern Pipe Supports Corp. Catalog to indicate the type of installation required.

B. Hangers for steel, iron, or plastic piping shall be The Modern Corp. Government ring type hanger, No. 404, complete with band hanger, Fig. No. 540 malleable iron adjuster and rod, or approved equivalent. Hanger bands shall be flat and suitable for application of insulation over the hanger and pipe.

C. Hangers for all copper piping shall be The Modern Corp. No. 48, complete with copper-plated band, No. 121 copper-plated, malleable iron adjuster, and rod, for pipe sizes ½” thru 6”, or approved equivalent. PVC coated or epoxy coated hangers will be acceptable. Use The Modern Corp. No. 10, with special PVC coated or padded band, and Fig. No. 540 copper plated, malleable iron adjuster, and rod, for pipe sizes larger than 6”.

D. Insulation shall be installed over band hangers and all openings shall be sealed.

E. If clevis or loop hanger systems are utilized, insulation shields must be installed to maintain uniform insulation thickness and maintain insulation material characteristics.

F. Hanger rods installed in conjunction with hangers shall be not less than 3/8" for pipe sizes 1/2" to 2"; 1/2" for pipe sizes 2-1/2" and 3”; 5/8" for pipe sizes 4” and 5”; 3/4" for 6" pipe; and 7/8" for 8” to 12” pipe sizes. Hanger rods shall be larger where recommended by the hanger manufacturer.

G. Piping 2" and smaller supported on steel joists shall be hung from one joist with beam clamps. Piping over 2” and 3” in diameter shall be suspended from 1-1/4” steel pipe or steel angle,
laid-in and hook-bolted to the web members of the joists. Piping 4" and 5" shall be supported from three joists. Piping 6" and over shall be supported from not less than four joists.

H. Piping along walls shall be supported on substantial wall hangers securely attached to construction by means of inserts or expansion sleeves and bolts. Wall hangers shall be similar to Modern Corp. Fig. No. 284, or approved equivalent.

I. Vertical runs of exposed uninsulated piping shall be supported from walls with sections of Modern Corp. Chan-All channel-strut and strut clamps, or approved equivalent. For all insulated piping, use strut clamps sized to permit a continuous insulation installation.

1. “Klo-Shure” insulation couplings will be acceptable, as represented by Scott Industrial Systems (Tele No. 412-965-3279).

J. All supports directly in contact with copper piping shall be copper-plated, PVC coated, or epoxy coated, or equivalent. Ferrous metals shall not be used in contact with copper piping. Hangers for copper tubing 6” and smaller shall be copper-plated, PVC coated, or epoxy coated as herein specified; PVC coated or padded hangers for larger copper piping.

K. Hangers for pipe and tubing, installed horizontally, shall be spaced, at a maximum, as follows:

<table>
<thead>
<tr>
<th>PVC AND COPPER PIPE SUPPORT SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Size</td>
</tr>
<tr>
<td>Up to 1-1/2”</td>
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<tr>
<td>2” and Larger</td>
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</table>

<table>
<thead>
<tr>
<th>STEEL PIPE SUPPORT SPACING</th>
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</thead>
<tbody>
<tr>
<td>Pipe Size</td>
</tr>
<tr>
<td>1”</td>
</tr>
<tr>
<td>1-1/2”</td>
</tr>
<tr>
<td>2” &amp; 2-1/2”</td>
</tr>
<tr>
<td>3”</td>
</tr>
<tr>
<td>4” &amp; 5”</td>
</tr>
<tr>
<td>6”</td>
</tr>
<tr>
<td>8”</td>
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<tr>
<td>10”</td>
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<table>
<thead>
<tr>
<th>PEX AND CORRIGATED GAS PIPE SUPPORT SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Size</td>
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<td>2” &amp; 3”</td>
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<tr>
<td>4” &amp; 5”</td>
</tr>
<tr>
<td>6” &amp; 7”</td>
</tr>
<tr>
<td>8” &amp; 9”</td>
</tr>
<tr>
<td>10” &amp; 11”</td>
</tr>
</tbody>
</table>
L. All vertical runs of piping shall be supported at each floor and/or at specified intervals, by means of riser clamps. Copper tubing shall be protected against electrolysis, such as copper plating, PVC coating, or epoxy coating, or approved equivalent. Supports shall be placed at minimum ten (10) foot intervals for vertical pipe, except as otherwise dictated by NFPA recommendations for fire protection piping.

M. Where concentrated loads of valves, fittings, etc., occur, closer spacing may be necessary. Smaller pipe shall be provided with additional supports to prevent piping from sagging. Hangers must be installed not more than 12" from each change in direction of pipes.

N. Brass chromium plated pipe shall be supported by suitable cast brass, chromium plated supports. All securing devices shall have all exposed heads, finished chromium plated.

PART 3 – EXECUTION

3.1 INSTALLATION

A. All piping shall be supported from the building construction by the use of fixed or adjustable beam clamps, concrete inserts, lag bolts and lag screws from wood construction, brackets, extension rods, adjustable band ring pipe hangers, or other equipment as dictated by the type of building construction.

B. The Contractor shall place all hanger and support inserts in concrete. Special studs “shot” into concrete will not be permitted.

C. Perforated band iron, strap, split ring, wire, chain, or pipe hooks will not be permitted for hangers or supports of pipe.

D. Piping shall not be supported from any other piping systems, ductwork, conduit, etc. Piping shall only be supported by code approved and manufacturer recommended hanger systems connected directly to the building’s structure.

E. ALL hanger and support locations shall be coordinated and reviewed with the Architect, Structural, HVAC and Electrical Engineer Construction Representatives during construction. If any hanger locations or connection methods are unacceptable to any of the professional team (for example – penetrations of pre-cast concrete tees, from piping, uneven spacing or height, etc.), the Contractor shall relocate the support, at his own expense, to an approved location.

F. Attachments to, and penetrations of new or existing concrete structural tees for hanger connections shall be not be permitted until reviewed and approved by the Architect. The Contractor shall be responsible for the expense of all repairs required as a result of the installation of unauthorized attachments to, or penetrations of new or existing concrete structural tees.

G. Trapeze type hangers may be used for multiple parallel line installations. The Contractor shall submit sketches for the proposed hangers indicating the type of construction, number and size.
of piping, and maximum spacing to the Architect for approval. Include metal shielding for insulation to rest thereon to avoid crushing. Insulation must be continuous as specified. Electrolysis at pipe/hanger must be prevented.

3.2 UNACCEPTABLE HANGER AND SUPPORT INSTALLATIONS

A. It is unacceptable to support any pipe(s) or duct(s) from other pipe(s) or duct(s).

B. If unistrut is used to support piping, strap hangers are unacceptable since they do not allow for continuous insulation.

C. It is unacceptable for this Contractor to support his work from the hangers of other trades. All trades must install their own hangers.

D. Unacceptable hanger and support installations shall be corrected as directed by the Architect/Engineer at no cost to the Owner.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

PART 2 – PRODUCTS

2.1 EQUIPMENT IDENTIFICATION, VALVE TAGS

A. Where valves, cleanouts and similar equipment is located above removable tile ceilings or above access panels, the Contractor shall furnish and install identification labels on the corners of the access panels or removable ceiling tiles. Labels shall be provided with the words "VALVES," "CLEANOUT," and similar wording, so that the equipment may be readily located in the future.

B. Identification labels shall not exceed 3" in length and 1" in height. Black letters shall be 1/8" high on white background. Labels shall be manufactured of engraved Micarta or Bakelite with pressure-sensitive backing and shall be nonabsorbent, nonporous and colorfast. Adhesive backing shall be chemically compounded to hold tight and fast at wide temperature extremes. Labels shall be as manufactured by Seton Name Plate Company, Brady Co., MSI Services. Labels shall be additionally secured with screws or rivets. Flexible plastic punched tapes will not be acceptable. Labels shall be coordinated with those being installed under other contracts. All piping and equipment, insulated and uninsulated, shall be labeled under this contract.

C. All major pieces of plumbing equipment shall include, at a suitable and accessible observation point on the equipment, a manufacturer's stamped brass or aluminum identification plate, with all pertinent capacity data stamped on the plate. Identification plate shall include all specific data, such as model number, serial number, motor data, horsepower, capacities, sizes, amperes, power consumption, speed, flows, temperatures, working pressures, operating pressures, and similar factors as applicable. In addition, pumps shall include total head in feet and impeller sizes.

D. The Contractor shall be responsible for furnishing and attaching an identification plate for the above mentioned major equipment if not provided by the equipment manufacturer.

E. Equipment marking tags shall be engraved phenolic, 1/16” thick, and four edges binded, black with white lettering. The tag shall be securely mounted to the equipment. Tags shall be as organized per the Equipment Schedules, and include “date of installation and project number.”

F. The installations will not be considered acceptable unless identification plates and nameplates are attached.

G. All piping and equipment insulated and uninsulated, installed throughout this Contract, shall be stenciled with the name of the service and with an arrow indicating the direction of flow. Temperature of hot water systems shall also be included. Stenciling in exposed locations in finished areas must be coordinated with the Architect prior to installation.
H. Stenciled letters shall, in general, be plain block style, about 1” high, black, and shall be located near each branch connection, at each valve, at each change in direction, on each side of walls or floors, and at least every 30' on straight runs of pipe. On smaller runs of piping, center the designations. In lieu of stenciling, snap-around pipe markers by Seton Nameplate Co. "Set Mark," Brady, MSI Services, may be utilized. Identification and colors shall comply with ANSI A13.1. Snap – around markers shall be suitable for exterior use where utilized.

I. Where pipes are adjacent to each other, markings shall be neatly piped up. All markings shall be located in such a manner as to be easily legible from the floor. Markings on black pipes shall be white.

J. All labeling, color-coding, and identifying marks for all new piping and equipment shall match existing building’s identifications patterns. Coordinate all labeling with Owner and Architect prior to start of work.

2.2 VALVE DIRECTORY

A. The Contractor shall prepare a type written valve directory (and required copies) showing the number, location, use and normal position of valves installed under the Contract. Tag each valve controlling mains and branches, but not individual shutoff or local control valves on fixtures and equipment. Valve directory shall be a white print schedule enclosed in metal frame with glass front.

B. Each valve listed in the directory shall have a corresponding number 1-1/2" diameter brass or aluminum tag attached to the valve by means of a brass or aluminum "S" hook or chain. Numbers and code letters shall be as large as possible for identifying each service. Numbers and tags shall be coordinated with those being installed under the HVAC Contract. Valve tag numbers shall not be repetitious.

C. Provide two (2) additional copies of valve schedules in a hardback binder to the Owner.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Valve directory shall be installed at the location designated by the Architect.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SCOPE

A. The plumbing pipe insulation shall be as described in this section.

1.3 CODE COMPLIANCE

A. All insulation materials and installation procedures shall be in accordance with the minimum requirements of The International Energy Conservation Code.

PART 2 - PRODUCTS

2.1 INSULATION

A. Furnish and install insulation for the following piping systems (Domestic HW, CW, HW Recirc. and RWC) and equipment. All insulation and insulating materials, except as herein specified, shall be as manufactured by Knauf, Owens-Corning Company, or Manville. Insulation adhesives, sealers, cements, mastics, and other similar items, except as herein specified, shall be manufactured by HB Fuller, Mon-Eco, Childers, or Vimasco. Same type insulation materials shall be used consistently throughout the entire installation. Thicknesses shall be 1", except for Electric Water Cooler and Ice Machine Branch Drain Piping, which would be ½”.

B. Materials: All materials shall conform to the following:

1. Piping insulation shall be "heavy density," 1-piece molded fiberglass with factory applied type ASN/SSL "All Service" jacket with self-sealing lap. Average thermal conductivity shall not exceed .25 BTU-in. per square foot per degrees Fahrenheit per hour at a mean temperature of 75 degrees. Thickness shall conform to schedule for pipe size and service as specified herein.

2. Vapor-barrier jacket for the fiberglass system shall be white kraft paper bonded to aluminum foil and reinforced with glass fiber, and pressure sensitive, self-sealing lap adhesive conforming to the physical properties listed in next paragraph.

3. The fiberglass insulating system, including insulation, jacket adhesives, mastics and cements, shall have composite fire and smoke hazard ratings as tested under procedure ASTM E-84, NFPA 255, and UL 723, not exceeding: Flame Spread – 25, Fuel Contributed – 50, Smoke Developed – 50.

4. Fittings for the fiberglass system shall also be 25/50/50 rated as described in the preceding paragraph.
5. All products or their shipping cartons shall have label affixed indicating smoke and flame ratings.

C. Installation: Piping Systems

1. Insulation shall be applied on clean, dry surfaces after pressure testing and approval. All insulation shall be continuous, including through wall and ceiling openings and sleeves. Insulation on piping systems shall be maintained with a continuous unbroken vapor seal. Hangers, supports, anchors, guides and equipment shall be insulated and vapor sealed to prevent condensation.

2. All covered pipe shall be located a sufficient distance from walls, other pipes, ductwork, and other obstacles to permit the application of the full thickness of insulation specified; and if necessary, extra fittings and pipes shall be used.

3. All fiberglass insulation shall be installed with Bostitch outward clinched staples, one (1) every 3” and four (4) at each butt strap.

D. Fittings: Fiberglass systems operating below 60 degrees F: Fittings, valves, unions, and flanges shall be insulated with a fiberglass blanket, 1 pound per cubic foot density wrapped firmly under compression (minimum 2:1) to a thickness equal to the adjoining insulation, secured with No. 20 gauge galvanized annealed steel wire and given a smoothing coat of "asbestos-free" insulating and finishing cement and a vapor barrier sealer. Roof drain bodies, overflow roof drain bodies and RWC piping shall be insulated with fiberglass same as above.

E. Fiberglass systems Operating Above 60 Degrees F: Fittings, valves, unions, and flanges shall be insulated and finished with "asbestos-free" insulating and finishing cement to a thickness equal to the adjoining pipe insulation.

F. Services: All adhesives used for gluing insulations and insulating jackets shall be vermin and mildew-proof. The use of flour paste is prohibited.

G. Insulated fitting covers, as manufactured by Zeston, Proto, or Speedline will be acceptable for the fiberglass system.

H. Where new piping is connected to existing piping, and the insulation is removed, the piping shall be reinsulated and made continuous with the existing insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. This Contractor shall furnish and install non-conducting covering on the following piping and apparatus installed under this Contract. For performing and completing this work, this Contractor shall employ an Insulation Subcontractor specializing and experienced in commercial covering work, responsible to the Plumbing Contractor.

B. The following work shall be insulated under the Plumbing Contract:
1. Complete domestic water distribution systems, exposed and concealed. Insulate water piping installed within and around cabinetry and casework.

2. All capped water piping with valves arranged for future extension shall be insulated.

3. Condensate drain piping, this Contract, exposed, concealed, including check valves.

4. All domestic water connections to existing piping. All insulation, new and existing, shall be continuous and all existing insulation that remains must be joined with new insulation for a continuous system.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. All exposed hot, cold, and drain piping below fixtures for ADA usage shall be insulated, Zurn, McGuire, or Truebro, vandal-resistant as possible. Include insulation of P-Trap. Refer to Section (224000).

E. Application of insulation materials to piping and fittings shall be done in strict accordance with the manufacturers' recommendations. Where thickness of insulation is not specified, use applicable thicknesses recommended by the manufacturer for the specific use. Piping and equipment exterior shall be clean and dry and approved tests shall be completed before any insulation is applied.

END OF SECTION
SECTION 221116 – DOMESTIC WATER PIPING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SCOPE

A. The domestic hot, cold, and hot water return water piping shall be as hereinafter described in this section.

B. Refer to Section 220523 for interior water valves.

PART 2 – PRODUCTS

2.1 DOMESTIC WATER DISTRIBUTION PIPING INSIDE BUILDING

A. Interior domestic water piping above floor level shall be hard drawn copper tubing, Type "L", in accordance with ASTM B-88, with solder joint type wrot copper fittings. Copper tubing manufactured by Cambridge-Lee, Cerro, Mueller, Summit, or approved equivalent. Fittings by Nibco, Cambridge-Lee, Mueller, or approved equivalent.

B. Interior domestic water main piping above floor level, 1-1/4" and larger, shall be hard drawn copper tubing, Type "L", in accordance with ASTM B-88, with solder joint type wrot copper fittings. Copper tubing manufactured by Cambridge-Lee, Cerro, Nibco, Summit, or approved equivalent. Fittings by Nibco, Cambridge-Lee, Mueller, or approved equivalent.

C. All exposed piping and fittings at fixtures shall be polished chrome plated.

D. The use of any of the above listed materials shall be subject to the acceptability of that material with the prevailing local codes and utility company regulations. All water line installations shall conform with the requirements of the local Water Authority serving the building.

2.2 MECHANICALLY FORMED TEES FOR HARD TEMPER COPPER TUBING

A. The T-Drill assembly of copper tubing will be acceptable. Mechanically extracted collars shall be formed in a continuous operation consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height not less than three (3) times the thickness of the tube wall. The collaring device shall be fully adjustable to insure proper tolerance and complete uniformity of the joint. The joining branch shall be notched and dimpled in a single process so as to set the proper penetration of the branch into the fitting to assure a free flow joint.

B. All joints shall be brazed by certified contractors only in accordance with the Copper Development Association copper tube handbook using B-Cup Series metal filler metal. The T-Drill System shall conform to ASTM Designation F2014-00.

2.3 JOINTS AND CONNECTIONS
A. Joints in above-floor copper piping shall be assembled with lead-free solder using a non-corrosive flux. All copper tubing and fittings 2" and larger shall be tinned prior to making solder joint. All solder joints on tubing 2-1/2" and larger shall be made with the use of a circular flame torch. To be considered “lead free”, solder and flux must not contain more than 0.2% lead.

1. For copper piping 2" and larger, a Type "L" copper grooved mechanical coupling system will be acceptable, Victaulic, Gruvlok, or approved equivalent. Use valves as specified only.

2. For copper piping 4" and smaller above floor level, the Viega ProPress System of mechanical joint copper tubing assembly will be acceptable, Nibco Press System, or approved equivalent. The ProPress System shall consist of an electro-hydraulic pressure crimping tool, with sets of interchangeable crimping jaws, and ProPress special copper fittings. The fittings shall include an O-sealing ring, and shall require no torches, solders, flux, or special pipe burnishing or preparation. A permanent, watertight seal is made by crimping the fittings. Rated at 200 psi; tested to 600 psi. The systems shall be installed in accordance with manufacturer’s installation instructions and governing code requirements. Pipe supports shall be installed so that interior horizontal piping is in uniform alignment.

3. All screw joint copper pipe shall be made with flake graphite and oil or other approved pipe compound applied to the male threads only and screwed tight with not more than 2 threads on the finished joint exposed, and where pipe and fittings are chrome plated, all threads shall be concealed.

B. Suitable adapters shall be used when necessary for connection to fittings, valves, or other accessories having threaded ends.

2.4 ELECTROLYSIS CONTROL

A. The installation of copper piping shall be accomplished in such a way as not to touch or come in contact in any way with ferrous metal. Where copper tubing, piping, or fittings are anchored, supported or may come in contact with metal construction, an insulating non-conductor spacer similar to lead, rubber, fiber or plastic shall be installed to assure prevention of electrolysis.

B. Hangers supporting copper tubing shall be all copper, copper-plated or be large enough to accommodate the insulating pipe covering. Copper tubing piping shall not be (even temporarily) supported or secured to ferrous metal.

C. Connections between ferrous and copper piping shall be with dielectric fittings, Watts, Wilkins, Clearflow, or approved equivalent.

PART 3 – EXECUTION

3.1 WATER DISTRIBUTION

A. All piping shall be installed in spaces and adjacent to other surfaces with sufficient clearances to permit air relief of the hot water system. Air venting valves shall be installed at all trapped high points in the hot water piping. Air venting valves shall be as specified.
B. The water systems included under this Contract, interior and exterior, shall be thoroughly flushed upon completion of the installations. Clean out all strainers.

3.2 INSTALLATION OF PIPING AND VALVES

A. Wrapping threads or caulking screwed connections for tightness is prohibited. No horizontal piping shall be built-in or buried in partitions. No piping shall be erected over any motors, panelboards, switchboards, or other electrical equipment. Bending of piping will not be permitted; fittings for change of direction shall be utilized. All vertical piping shall be run plumb. All overhead horizontal piping and vertical piping in finished areas shall be concealed, except as otherwise indicated on the drawings.

B. Cut pipe accurately to measurements, and ream free of burrs and cutting splatter. Carefully align and grade pipe and work accurately into place. Fittings shall be used for any change in direction. Make adequate provisions for expansion and contraction. Install anchors to prevent pipe movement. Provide for expansion at every building expansion joint.

C. Protect open pipe ends to prevent trash from being placed in the piping during installation. Clean all dirt and cutting debris from pipes before making the next joint.

D. Small pipe shall be screwed or soldered as required to produce a tight system with full joints and no leaks. Pipe joints showing seepage and drips shall be dismantled and remade in proper way, as required for a substantial installation.

E. Copper pipe shall be carefully reamed back to full inside diameter and the mating surfaces shall be cleaned by brush or sandpaper. When clean, the paste flux shall be applied and the joint evenly heated and soldered. Any fittings discolored by heat shall be removed and replaced.

F. All valves to be soldered into piping shall be dismantled to prevent the heat from destroying packing and seats.

G. Valves installed in threaded or flanged piping shall be properly supported and pipes carefully installed to prevent damage or distortion of the valve.

H. Install minimum ¾” ball valve drains with vacuum breakers and threaded caps at every low place and air vents at every high place. Pipe shall slope as shown on the Drawings or in the Specifications. If slope is not shown or specified, slope in the direction of flow one (1”) inch per every forty (40’) feet.

I. Install pressure gauges, thermowells, and thermometers as specified or shown in details on the Drawings.

J. All valves must be accessible.

3.3 CLEANING AND TREATING OF PIPE SYSTEMS

A. Every pipe system shall be cleaned to remove trash, mill scale, cutting oil, welding, and burning splatter from the piping before any control devices are installed. If such debris has collected in valves, the valves shall be disassembled and cleaned prior to closing for the first time.
B. Brush and clean work prior to concealing, painting, and acceptance. Perform in stages if directed by the Architect.

C. Clean and repair painted exposed work, soiled or damaged, to match adjoining work before final acceptance.

D. After several hours of operation, each strainer shall be blown down. This shall be repeated as often as necessary to produce a clean discharge from the blowdown. Prior to turning the system over to the Owner, each strainer shall be cleaned, removed if necessary for this requirement.

3.4 INSTALLATION AND TESTING PROCEDURES

A. All domestic water distribution piping included under this Contract installed after the main PRV station shall be hydrostatically tested to a pressure of 150 psi, and maintained for a period of 2 hours with a pressure loss of not more than 5 psi. The exterior piping system included under this Contract shall be tested under a hydrostatic pressure of not less than 200 lbs. for at least two hours, or at 50 psi in excess of the maximum static pressure when the maximum static pressure is in excess of 150 psi, in accordance with NFPA requirements for water piping serving fire protection systems. The exterior water distribution system included under this Contract shall be installed and tested in compliance with the local Water Authority. Confirm requirements prior to bidding.

3.5 DISINFECTION OF WATER SYSTEM

A. Before being placed in service, all water piping, interior and exterior, included under this Contract, shall be chlorinated to the satisfaction of the Architect.

B. Prior to chlorination, all dirt, foreign matter shall be removed by a thorough flushing.

C. A water mixture of hypochlorite solution shall be applied by means of a solution-feed device.

D. Treated water shall be retained in the pipe long enough to destroy all non-spore forming bacteria. This period shall be at least 3 hours and preferably longer as may be directed.

E. After the chlorine treated water has been retained for the required time, the chlorine residual at the pipe extremities and at other representative points shall be at least 5 parts million.

F. Following chlorination, all treated water shall be thoroughly flushed from the newly installed piping at its extremities until the replacement water throughout its length shall, upon test, be equal to the water quality served from the municipal water supply system.

G. Should the initial treatment, in the opinion of the Architect, prove ineffective, the chlorination procedure shall be repeated until confirmed tests show the water sampled from the newly installed piping conforms to the requirements.

3.6 BRANCH PIPING TO FIXTURES AND EQUIPMENT

A. Branch piping shall be extended and connected to all fixtures and equipment requiring same. Sizes of such connections shall be as indicated on the drawings and the Fixture Schedule, or as
required by the particular piece of equipment or fixture being served. If the sizes of such connections are not clearly indicated, the Contractor shall verify the sizes required with the Architect prior to commencement of any roughing-in work. Changes to piping necessitated due to the Contractors’ failure to properly verify the required sizes shall be made at the Contractors' expense.

3.7 TESTING

A. Treated Water piping system included under this Contract shall be pressure tested with product water in accordance with manufacturer’s installation instructions. Do not use compressed air, gas or other compressed gases for testing. Do not test piping beyond piping working pressure.

END OF SECTION
SECTION 22 13 16 – SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SCOPE
A. The sanitary waste and vent piping systems shall be as hereinafter described in this section. Make all required connections into the interior sanitary drainage systems.

1.3 CODE COMPLIANCE
A. All sanitary materials and installation methods shall be subject to the acceptability of that material with the prevailing local plumbing codes.

1.4 PIPE AND MATERIALS
A. This Contractor shall furnish and install sanitary sewer and vent piping as indicated on the Drawings. Pipe sizes indicated are minimum sizes. Minimum size below bottom floor or below ground, interior, 4”. Pipe sizes shall be larger where required by local codes.

PART 2 – PRODUCTS

2.1 SANITARY SEWER AND VENT PIPING UNDERGROUND.
A. Polyvinyl Chloride (PVC) Plastic Pipe Schedule 40 DWV ASTM 2665 solvent weld. PVC foam core piping and fittings not permitted. PVC pipe and fittings as manufactured by Charlotte, Geneva, Spears, or approved equivalent.

1. SDR-35 PVC piping and fittings will be acceptable for larger interior piping underground where solvent welded Schedule 40 PVC piping and fittings cannot be obtained in those sizes.

B. Provide sanitary sewers exiting the building each with vents, house traps, and cleanouts within the limits of sewer construction included under this Contract work, as required by the prevailing plumbing code and/or the sewer authority having jurisdiction.

1. For sanitary mains that exit the building below structural components, piping shall be sleeved and encased in concrete a minimum of 2'-0” beyond of the structural component, on either side. Coordinate specific requirements with structural design prior to installation.

2. For sanitary mains that exit the building through structural components, piping shall be sleeved through the component. Installation, location, and depth of sleeves need to be strictly coordinated with General Contractor prior to installation.
2.2 SANITARY SOIL, WASTE, AND VENT PIPING ABOVE GROUND.

A. Polyvinyl Chloride (PVC) Schedule 40 Plastic Pipe (DWV) ASTM 2665 solvent weld. PVC foam core piping and fittings not permitted. PVC pipe and fittings as manufactured by Charlotte, Geneva, Spears, or approved equivalent.

B. Use for plenum areas and other required locations, piping shall be coated Cast Iron Hubless pipe and fittings and shall conform to ASTM A-888, CISPI 301. Pipe and fittings as manufactured by Charlotte, Tyler, or AB & I, DGS – or equivalent as approved by the Professional. Cast Iron piping system shall also be used in Boiler / Mechanical Room, Kitchen / Dishwashing, and other associated areas to a point 10’ – 0” outside the area in all directions.

1. Extra heavy weight coated cast iron hub and spigot soil pipe and fittings, ASTM A74, shall be utilized where required by local codes

C. Vent piping to atmosphere shall be minimum 3” diameter and terminate a minimum of 12” above roof level. Terminate vent piping at a higher height above roof level where required by local codes. Rigidly support all vent piping extending through roof.

D. For above ground drainage piping changes in direction, use long sweep fittings where possible; otherwise, short-sweep 1/4 bends, or combination Y and 1/8 bends, also Y's or in combination with other bends; use 45 degree Y or 90 degree Y short turn type for horizontal branches discharging to stacks; however, approval must be obtained for these locations.

F. Where new vent piping is internally connected to existing vent piping which extends through roof, verify height of that existing vent pipe above roof and modify same as necessary to conform with local code and local Plumbing Inspector requirements for correct vent pipe height above roof.

2.3 JOINTS AND CONNECTIONS

A. Joints in cast iron hub and spigot shall be made with either (1) a caulked joint using pig lead and oakum with at least 12 ounces of lead per inch of pipe diameter. Lead shall be run in one pouring; (2) a compression joint using a lubricated neoprene gasket, Mission, Tyler "Ty-Seal"; Charlotte Foundry, or AB & I, DGS – or equivalent as approved by the Professional.

1. Joints between cast iron hub and spigot pipes and threaded pipes shall be made same as above using a caulking spigot.

2. Joints in hubless cast iron pipe above floor level for building construction one (1) story and less, shall be made with a mechanical coupling composed of a heavy duty Type 304 stainless steel shield and neoprene slip-on gasket, ASTM C-1540, Husky HD 2000, Clamp-All 80, DGS – or equivalent as approved by the Professional. For building construction more than one (1) story, use Husky SD 4000, Clamp-All 80, or approved equivalent, heavy duty couplings. Gauges of equivalents must conform. Hubless cast iron pipe below bottom floor, below ground, below crawl space or walkway floors, or at exterior of building not permitted at any location.

3. Joints in threaded pipe shall be made with clean-cut uniform tapered threads, with suitable pipe joint compound.
B. Joints for Hubless Cast Iron Pipe and Fittings Above Grade

1. Couplings for joining hubless cast iron soil pipe and fittings conforming to ASTM A-888, shall be 3 inches wide for nominal pipe sizes 1 ½ to 4 inches in diameter, 4 inches wide for nominal pipe sizes 5 to 10 inches in diameter, and 5 5/8 inches wide for couplings 12 and 15 inches in diameter. Shields shall have a minimum thickness of .015 inches, (28 gage) type 304 stainless steel. Worm drive clamps shall be type 304 stainless steel with a minimum clamp torque of 80 in/lbs. Sealing Gasket shall be neoprene conforming to ASTM C-564. Couplings shall conform to Factory Mutual Standard 1680, Class 1, or ASTM C-1540, as manufactured by Clamp-All Products Models HI-TORQ 80 and HI-TORQ; or Huskey Technologies Model SD-4000.

   a. Alternative to above, cast iron split clamps secured by stainless steel bolts and nuts with neoprene gasket conforming to ASTM C-564; as manufactured by MG Coupling Company.

   b. Factory Mutual Approved Couplings may be hung with one hanger per length of pipe for 10 foot lengths and at every third fitting where they are contiguous in conformance with manufacturers installation instructions.

C. Joints in PVC pipe shall be accomplished with socket type fittings and solvent-cement welding for the interior DWV System, above floor or below bottom floor.

D. All transition joints in sewers between dissimilar materials or unequal sizes shall be made water and gas tight by means of an approved connection or adapter of the compression or mechanical seal type. The connector or adapter shall be manufactured of preformed Elastomeric Polyvinyl Chloride conforming to ASTM Standards C-425, C-594, C-564, and D-1869. Couplings of the mechanical seal type shall have tightening clamps or devices made of 305 stainless steel. The compression joint connector or adapter and flexible coupling shall be installed as recommended and specified by the manufacturer and each connector shall bear the manufacturer's name clearly visible when installed, such as manufactured by Fernco Joint Sealer Company, Indiana Seal, or Mission DGS – or equivalent as approved by the Professional.

E. All joints shall be made permanently gas and water tight.

F. The use of any of the above joints and connections shall be subject to their acceptability with the prevailing local plumbing codes.

2.4 CLEANOUTS

A. The Contractor shall furnish and install cleanouts at each change in direction greater than 45° in sanitary drainage systems, at the base of all sanitary drainage stacks, and at all other points indicated on the Drawings.

B. Cleanouts installed on under-floor piping, exterior piping, or piping below slab on grade floors shall be extended to floor level or grade level with 45 degree fittings.

C. Cleanouts on concealed piping shall be extended so as to be easily accessible from finish floor, ceiling, or wall.
D. Cleanouts shall be full pipe size up to and including 4", and shall be 4" on larger size piping, if approved by the local authorities having jurisdiction over the installations.

E. All cleanout equipment shall be Zurn, Josam, Smith, Mifab, Wade, or Watts. Refer to “Tamperproof Screws”, Section (220500).

1. Zurn ZN1443-VP / ZN1447-VP – Cleanout with nickel-bronze access cover with vandal-proof screws, for all piping concealed. For all locations other than where access panels or doors are noted. Plastic, PVC, or fiberglass type cleanout covers not acceptable.


F. For cleanouts on cast iron piping above floor level as described herein, cleanouts shall be cast bronze threaded plugs in wye fittings.

G. Floor cleanouts shall be furnished and installed with flashing flanges and clamping collars. Floor cleanouts on the bottom-most slab shall not require flashing.

H. Where vertical piping is installed in chases in finished rooms, extension pieces, if required, shall be placed in tees so as to bring cleanout plugs to the back of the cover plate set flush in the finished walls.

I. Except where cover plates are provided with a recess for inserts of the same material as the floor finish, all cover plates in floors of finished areas shall be scoriated nickel bronze. Frames for the cover plates shall be compatible with the finished flooring material.

J. Care shall be exercised in installing cleanouts to avoid locating them in surfaces to be carpeted. Provide additional piping as required to locate cleanouts in other more accessible surfaces.

K. The Contractor shall lubricate all plugs before installation and shall loosen all covers and plugs before final inspection as directed by the Architect.

2.5 FLOOR DRAINS

A. The Contractor shall furnish and install the following types of floor drains, by Zurn, Josam, Smith, Mifab, Wade, or Watts Refer to “Tamperproof Screws”, Section (220500). Plug any unused primer connections. All drains shall have associated “Pro Vent” Trap Seals for evaporation protection.

1. FD-1 – Zurn ZN415-BZ-P-VP Series, bottom outlet, coated cast iron body with polished nickel-bronze leveling strainer, ZN400BZ-VP, Type BZ, vandal-proof, or approved equivalent. All other strainers shall be 6" size. (Finished Areas)

2.6 TRAPS

A. Service weight or extra heavy weight cast iron, shall be used in accordance with applied piping system.
B. A separate trap shall be provided for each plumbing fixture which does not contain an integral trap. In general, all fixture traps shall be provided with accessible cleanout plugs located on the bottom of the bend.

C. Traps shall be set true with respect to their water seals.

PART 3 – EXECUTION

3.1 GRADE

A. Elevations and locations of cleanouts shall be adjusted to avoid interference with other utilities and equipment without additional expense.

3.2 FLASHING

A. Provide 48” square sheet lead, copper, or neoprene flashing for floor drains, funnel drains, floor sinks, and cleanouts, set integral with floor slab. Chloroloy, or approved equivalent non-plasticized chlorinated polyethylene waterproofing membrane will be acceptable for flashing of floor drains, funnel drains, floor sinks, and cleanouts.

B. Vents through new roof construction will be flashed by the General Contractor. Openings, patching, restoring, and flashing in existing roof by Roofing Contractor at Plumbing Contractor’s expense.

3.3 INSTALLATION AND TESTING PROCEDURES

A. Horizontal cast iron pipe and fitting installations above ground, 6” and larger, shall be suitably braced to prevent horizontal movements, at every branch opening or change of direction, by the use of braces, blocks, rodding, or other suitable method, in accordance with pipe manufacturer’s and Cast Iron Soil Pipe Institute’s installation instructions. Vertical cast iron pipe and fitting installations above ground of all sizes shall be secured at each stack base and at sufficiently close intervals to keep the system in alignment and to adequately support the weight of the pipe and its contents.

B. Unless noted otherwise on the Drawings or herein specified, or required to suit final floor elevations, all sanitary piping 3” and larger shall be installed with a uniform minimum slope of 1/8” to the foot and all sanitary piping 2” and smaller shall be installed with a uniform minimum slope of 1/4” to the foot, or as otherwise required by local codes.

C. Interior sanitary drainage piping shall be hydrostatically tested after completion of the roughing-in. Piping being tested shall be filled to the top of vent pipes, and left standing for a period of one (1) hour with no loss of water. Smoke tests will be acceptable if required by local authorities. Confirm requirements prior to bidding.

D. After testing and before final acceptance, the Contractor shall completely flush the entire sewer systems and appurtenances included under this Contract in sufficient volume to remove all settlement and debris to obtain free flow through each pipe. Flushing shall be accomplished by the use of automatic flush tanks, fire hoses, or other means approved by the Architect. Depths of water and velocities shall be as required to produce a hydraulic bore. Remove all obstructions and correct all defects discovered.
E. Exercise extreme care to prevent debris from entering floor drains or cleanouts. Carefully check invert elevations of floor drains to which connections are to be made.

3.4 CLEANING AND FLUSHING OF SANITARY SEWERS

A. The Contractor shall clean and flush out existing remaining interior sanitary sewers at locations throughout the building effected by this project, by the hydro-sewer cleaning method, using high pressure water.

B. The Contractor shall clean the designated sanitary sewers of all debris, grease, sand, sludge, soap, rocks, and accumulations, flush out, and ensure that all such sewers are completely free-flowing.

C. All sanitary sewer cleaning and flushing work shall be completed by the hydro-cleaning process, by a competent independent firm, with workers specifically skilled in this type of work.

D. A written report of the cleaning and flushing work and remaining condition of these existing sanitary sewers, shall be included. A copy of each shall be furnished to the Owner and the Architect.

E. All fees, charges, and costs for cleaning and flushing work shall be included under the Plumbing Contract.

3.5 FINAL INSPECTION

A. At the time of final inspection of the work performed under the Contract, the floor drains and cleanouts shall be complete in every respect and in perfect operating condition. All surplus materials of every description resulting from the work shall have been removed. Floor drains shall be free from debris, sand, silt or other obstructions. Any defects discovered in the floor drains, floor sinks, funnel drains, and cleanouts subsequent to this inspection shall have been corrected.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SCOPE

A. The storm drainage piping systems shall be as hereinafter described in this section. Make all required connections into the interior storm drainage systems.

1.3 CODE COMPLIANCE

A. All storm drainage pipe materials and installation methods shall be subject to the acceptability of that material with the prevailing local plumbing codes.

1.4 PIPE AND MATERIALS – GENERAL

A. This Contractor shall furnish and install storm sewer piping as indicated on the Drawings. Pipe sizes shall be larger where required by local codes.

B. Cast iron pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

PART 2 – PRODUCTS

2.1 STORM SEWER PIPING BURIED UNDERGROUND

A. Coated service weight Cast Iron hub and spigot pipe and fittings – ASTM A74. Cast iron pipe and fittings as manufactured by Charlotte, Tyler, AB & I, or approved equivalent.

1. Extra heavy weight coated cast iron hub and spigot soil pipe and fittings, ASTM A74, shall be utilized where required by local codes.

B. Provide storm sewers exiting the building each with vents, house traps, and cleanouts within the limits of sewer construction included under this Contract work, as required by the prevailing plumbing code and/or the sewer authority having jurisdiction.

1. For storm mains that exit the building below structural components, piping shall be sleeved and encased in concrete a minimum of 2'-0" beyond of the structural component, on either side. Coordinate specific requirements with structural design prior to installation.

2. For storm mains that exit the building through structural components, piping shall be sleeved through the component. Installation, location, and depth of sleeves need to be strictly coordinated with General Contractor prior to installation.
2.2 STORM DRAINAGE PIPING ABOVE GROUND

A. Polyvinyl Chloride (PVC) Schedule 40 Plastic Pipe (DWV) ASTM 2665. PVC foam core piping and fittings not permitted. PVC pipe and fittings as manufactured by Charlotte, Geneva, Spears, or approved equivalent.

B. Use for plenum areas and other required locations, piping shall be coated Cast Iron Hubless pipe and fittings and shall conform to ASTM A-888, CISPI 301. Pipe and fittings as manufactured by Charlotte, Tyler, AB & I, or approved equivalent.

C. For above ground drainage piping changes in direction, use long sweep fittings where possible; otherwise, short-sweep 1/4 bends, or combination Y and 1/8 bends, also Y's or in combination with other bends; use 45 degree Y or 90 degree Y short turn type for horizontal branches discharging to stacks; however, approval must be obtained for these locations.

2.3 PRIMARY ROOF DRAINS WITH INTEGRAL OVERFLOW DRAIN

A. The Contractor shall furnish and install the following types of primary roof drains, each with integral overflow, by Zurn, Froet, Josam, Smith or Mifab. The following numbers are from the Zurn catalog unless otherwise specified:

B. Roof Drain – Zurn Z103-C-E or Z103-45-C-E dual outlet, Series coated cast iron deep sump body with overflow pipe, underdeck clamp, static extension, roof sump receiver, integral membrane flashing clamp/gravel guard, and painted low silhouette dome, with 90° or 45° pipe connection, or approved equivalent. Size as indicated on the drawings. Refer to Plumbing scope for painting requirements. Coordinate exact components with roof construction. The No. Z103-C-E-DP or No. Z103-45-C-E-DP “Top-Set” roof drain with roof deck plate, or approved equivalent, will be acceptable.

2.4 JOINTS AND CONNECTIONS

A. Joints in cast iron hub and spigot shall be made with either (1) a caulked joint using pig lead and oakum with at least 12 ounces of lead per inch of pipe diameter. Lead shall be run in one pouring; (2) a compression joint using a lubricated neoprene gasket, Mission, Tyler "Ty-Seal"; Charlotte Foundry, AB & I, or approved equivalent.

1. Joints between cast iron hub and spigot pipes and threaded pipes shall be made same as above using a caulking spigot.

2. Joints in hubless cast iron pipe above floor level for building construction one (1) story and less, shall be made with a mechanical coupling composed of a heavy duty Type 304 stainless steel shield and neoprene slip-on gasket, ASTM C-1540, Husky HD 2000, Clamp-All 80, or approved equivalent. For building construction more than one (1) story, use Husky SD 4000, Clamp-All 80, DGS – or equivalent as approved by the Professional, heavy duty couplings. Gauges of equivalents must conform. Hubless cast iron pipe below bottom floor, below ground, below crawl space or walkway floors, or at exterior of building not permitted at any location.
3. Joints in threaded pipe shall be made with clean-cut uniform tapered threads, with suitable pipe joint compound.

B. Joints for Hubless Cast Iron Pipe and Fittings Above Grade

1. Couplings for joining hubless cast iron soil pipe and fittings conforming to ASTM A-888, shall be 3 inches wide for nominal pipe sizes 1 ½ to 4 inches in diameter, 4 inches wide for nominal pipe sizes 5 to 10 inches in diameter, and 5 5/8 inches wide for couplings 12 and 15 inches in diameter. Shields shall have a minimum thickness of .015 inches, (28 gage) type 304 stainless steel. Worm drive clamps shall be type 304 stainless steel with a minimum clamp torque of 80 in/lbs. Sealing Gasket shall be neoprene conforming to ASTM C-564. Couplings shall conform to Factory Mutual Standard 1680, Class 1, or ASTM C-1540, as manufactured by Clamp-All Products Models HI-TORQ 125 and HI-TORQ; or Huskey Technologies Model SD-4000, DGS – or equivalent as approved by the Professional

   a. Alternative to above, cast iron split clamps secured by stainless steel bolts and nuts with neoprene gasket conforming to ASTM C-564; as manufactured by MG Coupling Company.

   b. Factory Mutual Approved Couplings may be hung with one hanger per length of pipe for 10 foot lengths and at every third fitting where they are contiguous in conformance with manufacturers installation instructions.

C. Joints in PVC pipe shall be accomplished with socket type fittings and solvent-cement welding for the interior DWV System, above floor or below bottom floor.

D. Connections from Roof Drains to associated storm piping shall use Husky Series 2000 stainless steel coupling, with four (4) stainless steel clamps. Gasket shall be manufactured from a properly volcanized virgin compound in which the primary elastomer is polychloroprene conforming to ASTM C-564.

E. All transition joints in sewers between dissimilar materials or unequal sizes shall be made water and gas tight by means of an approved connection or adapter of the compression or mechanical seal type. The connector or adapter shall be manufactured of preformed Elastomeric Polyvinyl Chloride conforming to ASTM Standards C-425, C-594, C-564, and D-1869. Couplings of the mechanical seal type shall have tightening clamps or devices made of 305 stainless steel. The compression joint connector or adapter and flexible coupling shall be installed as recommended and specified by the manufacturer and each connector shall bear the manufacturer's name clearly visible when installed, such as manufactured by Fernco Joint Sealer Company, Indiana Seal, or Mission.

F. All joints shall be made permanently gas and water tight.

G. The use of any of the above joints and connections shall be subject to their acceptability with the prevailing local plumbing codes.

2.5 CONDENSATE DRAIN SYSTEM

A. All condensate drain piping from HVAC equipment will be furnished and installed under the HVAC Contract, except for certain condensate drain piping connected to storm rain
condensate drain piping aboveground shall be polyvinyl chloride (PVC) Schedule 40 plastic pipe (DWV) ASTM 2665, unless in plenum spaces. All condensate drain piping in plenum spaces shall be Cast Iron hub and spigot pipe and fittings as specified.

1. Where condensate drain piping are extended to rain conductors, use bronze ball check valves at connection, the Apollo 61-12K, with light spring, or approved equivalent.

2.6 CLEANOUTS

A. The Contractor shall furnish and install cleanouts at each change in direction greater than 45° in sanitary drainage systems, at the base of all sanitary drainage stacks, and at all other points indicated on the Drawings.

B. Cleanouts installed on under-floor piping, exterior piping, or piping below slab on grade floors shall be extended to floor level or grade level with 45 degree fittings.

C. Cleanouts on concealed piping shall be extended so as to be easily accessible from finish floor, ceiling, or wall.

D. Cleanouts shall be full pipe size up to and including 4", and shall be 4" on larger size piping, if approved by the local authorities having jurisdiction over the installations.

E. All cleanout equipment shall be Zurn, Josam, Smith, Wade, or Watts DGS – or equivalent as approved by the Professional. Refer to “Tamperproof Screws”, Section 15051 (220500).

1. Zurn ZN1443-VP / ZN1447-VP – Cleanout with nickel-bronze access cover with vandal-proof screws, for all piping concealed. For all locations other than where access panels or doors are noted. Plastic, PVC, or fiberglass type cleanout covers not acceptable.


3. Zurn Z1400-HD-VP – Adjustable exterior extra heavy-duty round cleanout, vandalproof screws, cast bronze plug, set in concrete slab, 24” x 24” x 6” thick. Provide nickel-bronze finish cleanouts at any finish entrances or exits of building. Refer to the drawing details.

F. For cleanouts on PVC piping above floor level, cleanouts shall be PVC threaded plugs in wye fittings. For cleanouts on cast iron piping above floor level as described herein, cleanouts shall be cast bronze threaded plugs in wye fittings.

G. Floor cleanouts in interior heavy duty traffic areas, shops, equipment rooms, and janitor’s closets, and storage rooms shall be cast bronze flush floor plugs, Zurn ZARB-1470-PW, or approved equivalent. Provide two (2) plug wrenches only, total.
H. Floor cleanouts shall be furnished and installed with flashing flanges and clamping collars. Floor cleanouts on the bottom-most slab shall not require flashing.

I. Where vertical piping is installed in chases in finished rooms, extension pieces, if required, shall be placed in tees so as to bring cleanout plugs to the back of the cover plate set flush in the finished walls.

J. Except where cover plates are provided with a recess for inserts of the same material as the floor finish, all cover plates in floors of finished areas shall be scoriated nickel bronze. Frames for the cover plates shall be compatible with the finished flooring material.

K. Care shall be exercised in installing cleanouts to avoid locating them in surfaces to be carpeted. Provide additional piping as required to locate cleanouts in other more accessible surfaces.

L. The Contractor shall lubricate all plugs before installation and shall loosen all covers and plugs before final inspection as directed by the Architect.

2.7 TRAPS

A. Service weight or extra heavy weight cast iron, or PVC, shall be used in accordance with applied piping system.

B. Traps shall be set true with respect to their water seals.

C. Install traps on any and all parts of interior and exterior storm collection system as required by local code having jurisdiction.

2.8 SPLASHBLOCKS

A. Splashblocks for termination of drain piping shall be precast concrete construction. Splashblocks shall be approximately 24” L. x 8” wide, constructed of 2500 psi minimum concrete. PVC, fiberglass, or plastic type splashblocks will not be acceptable.

2.9 SECONDARY DRAIN PIPE TERMINATIONS

A. Zurn ZAB-199-SS downspout nozzle, Josam, Smith Wade, or Watts, all nickel-bronze body, threaded or no-hub inlet, and decorative face of wall flange and outlet nozzle, with removable stainless steel rodent screen and PVC connection.

B. Stainless steel securing screws by Plumbing Contractor.

C. Terminate storm drainage with centerpiping of downspout covers 24” above finished grade, or at height(s) directed by the Architect.

PART 3 – EXECUTION
3.1 GRADE
A. Elevations and locations of primary roof drains, overflow roof drains, and cleanouts shall be adjusted to avoid interference with other utilities and equipment without additional expense.

3.2 FLASHING
A. Provide 48” square sheet lead, copper, or neoprene flashing for cleanouts, set integral with floor slab. Chloroloy, or approved equivalent non-plasticized chlorinated polyethylene waterproofing membrane will be acceptable for flashing of cleanouts.
B. Roof drains in roof will be flashed by the General Contractor.

3.3 INSTALLATION AND TESTING PROCEDURES
A. Horizontal cast iron pipe and fitting installations above ground, 6” and larger, shall be suitably braced to prevent horizontal movements, at every branch opening or change of direction, by the use of braces, blocks, rodding, or other suitable method, in accordance with pipe manufacturer’s and Cast Iron Soil Pipe Institute’s installation instructions. Vertical cast iron pipe and fitting installations above ground of all sizes shall be secured at each stack base and at sufficiently close intervals to keep the system in alignment and to adequately support the weight of the pipe and its contents.
B. Unless noted otherwise on the Drawings, or required to suit final floor elevations, all storm piping 3” and larger shall be installed with a uniform minimum slope of 1/8” to the foot and all storm piping 2” and smaller shall be installed with a uniform minimum slope of 1/4” to the foot, or as otherwise required by local codes.
1. Maintain 30” minimum ground cover above exterior piping.
C. Interior storm drainage piping shall be hydrostatically tested after completion of the roughing-in. Piping being tested shall be filled to the top of primary roof drains or overflow drains and left standing for a period of one (1) hour with no loss of water. Smoke tests will be acceptable if required by local authorities. Confirm requirements prior to bidding.
D. After testing and before final acceptance, the Contractor shall completely flush the entire storm systems and appurtenances included under this Contract in sufficient volume to remove all settlement and debris to obtain free flow through each pipe. Flushing shall be accomplished by the use of automatic flush tanks, fire hoses, or other means approved by the Architect. Depths of water and velocities shall be as required to produce a hydraulic bore. Remove all obstructions and correct all defects discovered.
E. Exercise extreme care to prevent debris from entering primary roof drains, overflow roof drains, and cleanouts.

3.4 FINAL INSPECTION
A. At the time of final inspection of the work performed under the Contract, the roof drains, and cleanouts shall be complete in every respect and in perfect operating condition. All
surplus materials of every description resulting from the work shall have been removed. Roof drains shall be free from debris, sand, silt or other obstructions. Any defects discovered in the roof drains and cleanouts subsequent to this inspection shall have been corrected.

END OF SECTION
PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SCOPE

A. The plumbing fixtures, trim, accessories, and miscellaneous equipment shall be as shown on the drawings. Additional manufacturer’s names of fixtures, trim, and miscellaneous equipment shall be listed herein.

B. All plumbing fixtures and trim shall be new and of the best quality. All fixtures shall bear the manufacturers’ guarantee label or trademark, indicating first quality.

C. ALL fixtures and associated trim, including traps, stops, faucets, flush valves, etc., shall be ‘Lead Free’ or ‘No Lead’ and shall be documented as such as part of the submittal process.

D. All vitreous china, cast iron, and prefabricated fiberglass, polyethylene, acrylic, or polypropylene fixtures shall be white and all fixtures of all types shall be specially selected, free from cracks, chips, flaws, stains and warping, and other defects. Fixtures shall be replaced by the Contractor, and the guarantee period on such replaced fixtures shall be extended for the full term of the guarantee from the date of replacement.

E. The Contractor shall refer to the Drawings for the quantities of plumbing fixtures of each kind to be furnished.

F. Provide adapters on all final piping connections to equipment furnished under other contracts or by the Owner.

G. All fixtures and trim shall be as listed below. Confirm requirements of all fixtures, trim, and manufacturers with Owner prior to ordering. Trim shall be commercial grade.

1. Water Closets, Lavatories - Zurn, American-Standard Brands, Kohler, or Sloan
2. Lavatory Faucets – Zurn, Chicago Faucet, Speakman, Delta, or T&S Brass
3. Waste/Trap Assemblies – Zurn, McGuire Mfg., or Kohler
4. Water Supplies/Stops – Zurn, McGuire Mfg., or Kohler
5. Insulation Kits – Zurn, McGuire, or Truebro

H. All fixtures and equipment shall be properly trapped in accordance with local code requirements.
I. All exposed piping to fixtures shall be chrome plated. Chrome traps and chrome tubing shall be 17 gauge minimum. All traps of all types, exposed and accessible concealed, shall each include cleanout. Chrome finishes shall not be required for fixtures that require insulation kits.

J. All escutcheons shall be chrome, cast brass, set screw type, including on drain assemblies, water supplies at fixtures, and including piping inside fixture cabinets.

K. Plumbing Contractor shall furnish templates to General Contractor for cut-out work for built-in sinks and lavatories. Confirm available cabinet sizes with the General Contractor or Equipment Supplier prior to ordering counter sinks or counter lavatories of any type.

L. Supply piping to fixtures, faucets, and shower heads, shall be securely anchored to prevent movement.

M. All ADA water closet flushing handles shall be mounted on wide side of toilet areas.

N. Contractor shall coordinate all installations with Architectural Drawing elevations and ADA required clearances.

O. To inhibit the growth of bacteria, mold, fungi, and other microorganisms, a permanent anti-microbial product protection coating of inorganic silver-ion technology shall be applied to metal fixture trim and accessories and shall be included under the Plumbing Contract as herein specified. The coating shall be “Sani or approved equivalent guard”, by CHG (Component Hardware Group), as a basis of design, McGuire, or other same coating manufacturer. Contractor shall arrange to have coating applied to metal fixture trim and accessories furnished under this Contract. Have coating applied to the following (but not limited to) fixture trim and accessories:
   1. P-traps (interior).
   2. Lavatory drain assemblies.
   3. Infrared faucets, handles, spouts, escutcheons, and support base assemblies.

PART 2 - PRODUCTS

2.1 FIXTURES

A. L-1 – Wall-Mounted Bowl with Infrared Faucet – Disabled Height
   1. Zurn No. Z5364 vitreous china wall hung lavatory, 20” x 18”, with faucet holes on 4” centers. Fixture shall be provided with hanger plate and holes for concealed arm carrier systems. Mount at ADA Height.
      a. Zurn Series Z1231-79 carrier. Use Z1231-D-79 carrier where back-to-back installation is practical. The Zurn “EZ Set” lavatory support system will be acceptable. Zurn “CB” carrier bank supports acceptable.
   2. Drain shall be Zurn No. Z8746-PC flat perforated strainer drain with 1-1/4” offset tailpiece.
3. P-Trap assembly shall be Zurn No. Z8701-9-PC, 1-1/4” x 1-1/2”, with cleanout.

4. Water supplies shall be Zurn Z8800-XL-LRLK-PC. Brass ball valve type “convertible” stops acceptable. Provide Zurn No. Z8946-3-NT ADA compliant insulation kit for waste and supply assemblies.

B. **Battery-Powered** Faucet shall be Zurn No. Z6930-XL-IM-CP4-N-TMV-1, ‘Lead Free’, heavy duty cast brass spout, polished chrome plated finish, 30 second maximum safety shutoff time, 4 AA batteries-included, integral above deck mixing lever, 0.5 GPM vandal-resistant laminar flow spray outlet, and 5 year manufacturer’s warranty covering mechanicals, batteries, electronics and solenoid, and faucet finish.

2.2

A. WC-1 – Floor-Mounted Water Closet with **Infrared** Flush Valve – Disabled Height

1. Vitreous china Zurn No. Z5665-BWL1, 1.6 gallon per flush, low consumption, siphon jet, elongated bowl, floor mounted closet with 1-1/2” top spud and bolt caps, ADA Compliant.

2. **Battery-Powered Flush** Valve shall be Zurn No. ZER6000AV-CPM-WS1, 1.6 gallon per flush.

B.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All fixtures, trim, accessories, and equipment shall be assembled and installed according to manufacturers' recommendations in a neat and workmanlike manner.

B. Thoroughly clean all fixtures, trim, accessories, and equipment installed under this Contract.

C. Refer to the Architectural and Plumbing Drawings for scheduled mounting heights and clearances for fixtures and equipment. Particular attention is directed to mounting and clearances for ADA fixtures.

D. Upon completion of this Contract, the Plumbing Contractor shall furnish the Owner’s maintenance personnel with a Supplier faucet repair kit furnished by the approved faucet supplier.

E. Caulk with white silicone sealant caulk on all wall and floor contact edges on all fixtures, or of color caulk selected by the Architect. Caulk shall be of suitable type which can be painted.

F. **Individual mixing valves** shall be utilized at certain fixtures and equipment receiving hot water as designated. The Plumbing Contractor shall verify exact requirements, quantities, and locations of mixing valves with the local Plumbing fixture schedule prior to ordering or installation.

END OF SECTION
DIVISION 23

MECHANICAL
SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Escutcheons.
7. HVAC demolition.
8. Equipment installation requirements common to equipment sections.
9. Concrete bases.
10. Supports and anchorages.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.


G. Solvent Cements for Joining Plastic Piping:
   1. CPVC Piping: ASTM F 493.
   2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.3 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.
C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.4 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C. Pressure Plates: Carbon steel. Include two for each sealing element.

D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
   1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.


G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.
2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.
   1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
   1. Finish: Polished chrome-plated.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
   1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
   3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
   4. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   5. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   6. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. **Mechanical Sleeve Seal Installation:** Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. **Fire-Barrier Penetrations:** Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

Q. **Verify final equipment locations for roughing-in.**

R. **Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.**

3.3 **PIPING JOINT CONSTRUCTION**

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. **Soldered Joints:** Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. **Brazed Joints:** Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. **Threaded Joints:** Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. **Damaged Threads:** Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. **Welded Joints:** Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. **Flanged Joints:** Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. **Plastic Piping Solvent-Cement Joints:** Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.

2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

4. PVC Nonpressure Piping: Join according to ASTM D 2855.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

   1. Plain-End Pipe and Fittings: Use butt fusion.
   2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

   1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
   3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.
3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Condition and other Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF WORK

A. The Contract requirements include the providing of all labor, materials, equipment and appliances, and in performing all operations in connection with the installation of HVAC Construction Work complete for this Project, in strict accordance with this Section of the Specifications and the applicable drawings.

B. At the completion of the project, all systems shall be calibrated, tested, balanced, commissioned, and all systems shall be operating as intended.

C. Contractor is hereby bound by all applicable portions of all Contract Documents and Supplemental Specifications bound herein or included by reference.

D. In all cases where a device or part of equipment is herein referred to in the singular, such reference applies to as many such items as are required to complete the installation.

E. Provide all related and miscellaneous components or appurtenance to make all specified systems complete and functional.

F. Perform all work in accordance with work of all other contractors on this project.

G. Install work in phases during the construction period; coordinate mechanical schedule and operations with other trades and with construction schedule.

H. The work to be performed by the HVAC Contractor under these Specifications and the accompanying Drawings comprises the furnishing of all labor, materials, tools, and other services and facilities necessary for the complete installation of, but not necessarily limited to the following:

1. Demolition
   a. Remove existing air handling system(s) serving the auditorium, stage, and immediate support areas including supply fan, ductwork, coils, filters, branch piping, controls, and associated accessories, as designated on drawings.
   b. Remove portions of existing hot water system including convectors, radiation, enclosures, branch piping, valves, as designated on drawings.
   c. Disconnect and remove or alter existing piping systems as indicated or required to install new work. All existing piping and cut systems to be capped shall be capped in a concealed manner; exposed pipe nipples and
caps will not be acceptable, unless located in areas which do not have ceilings.

d. Disconnect and remove supply, return, outdoor air and mixed air ductwork system including diffusers, registers, dampers and other accessories, as indicated or required to install new work.

2. New

a. Provide two new packaged rooftop energy recovery units with integral air cooled heat pumps. Units shall be factory provided with variable speed supply and exhaust fans (with VFD's), energy recovery wheel (with VFD), direct expansion cooling with hot gas reheat, heating hot water coil, filters, controls, and auxiliaries.

b. The installation of low velocity supply air ductwork, insulation, grilles, registers, diffusers, supports and all other accessories and equipment as shown, specified and required for complete operating air distribution systems. All supply air ductwork must be externally insulated, unless noted otherwise.

c. Furnish combination starter/disconnects, disconnect switches, magnetic motor starters, manual motor starters and fuses to the Electrical Contractor for installation for all HVAC equipment. Coordinate all electrical requirements with the Electrical Contractor before ordering any such equipment and following review of submittals.

d. Install duct-mounted smoke detectors furnished by the Electrical Contractor. Furnish and install all control wiring from the duct-mounted smoke detectors to the air handling unit motor starters for unit shutdown. Duct-mounted smoke detectors will be furnished and connected to the fire alarm system by the Electrical Contractor.

e. Provide new low-pressure supply duct systems, return air duct systems and exhaust air duct systems as indicated. Provide new manual damper of the single leaf type in each new and existing branch supply, return and exhaust air ductwork, for balancing air delivery.

f. Provide vibration isolation devices.

g. Provide 1/2” plywood overlay for the bonded roof where work is being done. Any repairs to the roof caused by this Contractor shall be repaired at this Contractor's expense. All roofing work shall be done by the Roofing Contractor that installed the bonded roof. Roof bond shall be maintained.

h. Provide all pipe, fittings, valves, pipe strainers, hangers, anchors, expansion loops, sleeves, plates and auxiliaries required and necessary for the complete and operating installation of hot water piping, condensate piping, drain and vent piping.

i. Identify all piping systems and tag all valves. Provide valve chart.

j. Provide insulation for all drain piping, hot water piping and portions of ductwork.

k. Provide all structural steel supports, concrete and masonry foundations, and steel lintels for equipment furnished and installed under this contract, unless otherwise noted.

l. Provide all cutting and patching of existing building construction for work required under this contract, unless otherwise noted.

m. Contractor shall be responsible for maintaining all existing utility services during construction.
n. Furnish access panels required under this contract. Turn over to General Contractor for installation.

o. Provide new electric and direct digital computer-based systems of automatic temperature control with renovations to existing systems as specified and indicated.

p. Provide all testing and balancing of all new systems. Submit balance report.

q. Perform commissioning of all systems and controls. Submit commissioning report.

1.3 BASE BID AND ALTERNATE BIDS
A. Refer to Division 01 for descriptions of the Base Bid and Alternate Bids.

1.4 WORK BY OTHERS
A. The following construction and equipment related to the work under this Contract will be furnished or provided by others, unless noted otherwise:

1. Openings in new roof and roof deck. (General Contractor) Openings and patching in existing roof and roof deck by General Contractor.

2. Openings in new exterior walls. (General Contractor) Cutting and patching of existing exterior walls. (General Contractor)

3. Furring around new piping. (General Contractor)

4. Final painting of new interior surfaces. (General Contractor)

5. Final painting of existing interior walls, floors and ceilings where the surfaces are being refinished and remodeled under the General Contract. (General Contractor) Where the existing area is to be repainted by the General Contractor, the HVAC Contractor must repair his openings ready to paint. Refer to General Construction drawings for finishes.

6. Recesses and opening in new construction for piping and equipment. (General Contractor)

7. New chases for piping where specifically shown on the drawings. (General Contractor)

8. Funnel and floor drains required for the various equipment. (Plumbing Contractor)

9. The removal of existing power wiring, conduit and boxes for existing removed HVAC equipment. (Electrical Contractor)

10. Furnish and installation of all line and load side power wiring to all new electrically operated HVAC equipment. (Electrical Contractor) All control and interlock wiring, both low and line voltage shall be included under the HVAC Contract as hereinafter specified for the HVAC equipment, unless noted otherwise.

11. The Electrical Contractor will be responsible for all power wiring and associated terminations to line and load side as well as mounting of all combination starter/disconnects, magnetic starters, VFD's manual starters, disconnect switches, etc. furnished by the HVAC Contractor and external to equipment they are designated to serve.

12. Furnishing of duct mounted smoke detectors. (Electrical Contractor) Wiring to fire alarm system by Electrical Contractor.
PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Condition and other Division 01 Specification Sections, apply to this Section.

1.2 HVAC WORK

A. The word "building" used throughout these specifications shall be interpreted to mean the entire Building Complex.

B. The actual runs and locations of all piping, ductwork, equipment, etc., shall be determined at the site and shall be installed to meet the various conditions at the building. It is, however, the HVAC Contractor's responsibility to predetermine the exact locations of ductwork, piping, and equipment, and to notify the other contractors accordingly to avoid confliction with other lines and equipment. Any changes necessary to conceal pipes, ductwork or clear pipes and equipment of other trades shall be made without additional expense to the Owner. This Contractor shall be responsible to create ductwork and HVAC piping coordination drawings and distribute to other contractors for coordination and sign off. Refer to Subsection 3.5 for further clarification.

C. No piping, ductwork or equipment shall be installed without first obtaining sign off from the other trades. Should such installation occur and then subsequent conflicts arise, this Contractor shall, at his own expense, remove all that is in conflict and reinstall appropriately.

D. All work shall be executed and all equipment constructed and installed in accordance with the requirements of the State Building Code, the Department of Labor and Industry, ASME, Department of Environmental Resources, Department of Labor, Safety and Health Regulations for Construction, OSHA, National Fire Protection Association, the National Electrical Code as amended to date of bidding, and all federal, state, county and local ordinances and regulations. Nothing contained in these specifications or shown on the drawings shall be construed to conflict with the aforesaid codes, ordinances, or regulations. Certificates of approval shall be obtained from any department issuing same, and shall be turned over to the Owner at the completion of the work. All fees and permits required shall be satisfied and obtained by the Contractor and the cost shall be included in the Contract price.

E. The Contractor shall carefully examine the general building drawings and all mechanical and electrical drawings, and carry on his work so as not to delay or interfere with the work of other trades. He shall obtain in writing from the other contractors such data as is necessary to coordinate his work with other branches. As the work in the building nears completion, all threading, cutting, etc., shall be done where directed by the Architect. Upon completion of the work, all remaining waste materials and rubbish resulting from the Contract work shall be
removed from the building and premises. The Contractor shall review the phasing schedule and meet all requirements of the schedule. The building must be kept in use at all times.

F. Where the phrase "or approved equivalent," "or equivalent" or "approved" appears in these specifications, it shall refer to the approval of the Architect on the material or equipment involved.

G. The terms "The Contractor" or "This Contractor" or "the HVAC Contractor" mentioned in these specifications refers to the Contractor responsible for the work and equipment included in these specifications.

H. The General Contractor will provide chases and openings in walls, floors, ceilings, and partitions of new construction to receive pipe lines, risers, ducts, and other equipment insofar as it is possible to predetermine the exact location, but the Contractor shall install his work sufficiently in advance of the building construction to permit his work to be built into place. This Contractor shall advise the General Contractor of the exact size and location of all chases and openings required for the installation of his work, and shall check size and location of all such chases and openings provided by the General Contractor.

I. The HVAC Contractor shall furnish and install all necessary structural steel members for the proper support of all piping, ductwork, and equipment furnished and installed under this Contract.

J. The Contractor shall furnish and place all sleeves required for pipes or ducts passing through new floors, walls and ceilings before such general construction work is built into place. The Contractor shall place all inserts required for hangers and supports, as the construction work progresses, so that unnecessary cutting of construction work will be eliminated.

K. Contractor's particular attention is directed to the Present Building construction. The HVAC Contractor shall furnish and install all necessary structural steel members for the proper support of all piping, ductwork, and equipment furnished and installed under this Contract. Refer to the Architect's front end specifications for additional requirements.

L. The Contractor shall do all cutting and patching required for the installation of his work.

M. Advance work as rapidly as possible to permit the heating and cooling systems to be used when it is required for all areas of the building. The installation of equipment shall follow the phasing schedule. Instruct the Operating Personnel as to the proper care and maintenance of all systems. However, this Contractor shall operate the new systems until the new systems are complete while the building is under construction. He shall also coordinate the operation of the system with the Owner so that heat remains on in all areas during construction. Provide all required temporary heat as directed by the Construction Manager.

N. Equipment and materials of similar types shall be of the same manufacturer unless specifically indicated otherwise on the drawings or herein specified. All materials shall be strictly in accordance with the quality, style, and sizes as specified herein. Manufacturers' names and plate numbers are given in the specifications to denote a standard of quality, style, size, and type and shall exclude material of other manufacturers. The Contractor shall make final connections between all equipment furnished under this Contract and equipment furnished under other contracts as noted.
O. The materials used throughout shall be those of reputable manufacturers and shall be new and the best of their respective kinds. All equipment, components and materials shall be installed in a neat and workmanlike manner in accordance with best trade practices, manufacturer's recommendations, and applicable codes and standards and by men skilled in each particular branch of the work assigned to them. All work shall be installed subject to the approval of the Architect.

P. A complete list of materials proposed for each installation shall be submitted to the Architect for approval before delivery to the site. The Contractor shall submit samples of materials for approval at the site as requested by the Architect. Such materials may be incorporated into the structures after serving their purpose as samples.

Q. Where the Contractor elects to substitute approved materials or equipment for materials or equipment specified, as the basis of design. The Contractor will be held responsible for all structural, mechanical, and electrical changes required for their installation at no additional cost to the Owner. If additional engineering design is required, the Contractor shall reimburse the design engineer for all costs.

R. The Contractor shall be entirely responsible for all apparatus, equipment and appurtenances furnished by him or his Subcontractors in connection with the work, and special care shall be taken to protect all parts thereof in such manner as may be necessary or as may be directed. Protection shall include covers, crating, sheds, or other means to prevent dirt, grit, plaster, or other foreign substances from entering the working parts of machinery or equipment. Special care shall be taken to keep all open ends of pipes, ductwork, VAV/CAV Boxes and all other equipment, etc., closed while in storage and during installation. Where equipment must be stored outside the building, it shall be totally covered and secured with heavy waterproof tarps and kept dry at all times. Where equipment has been subjected to moisture, it shall be suitably dried out before placed in service. Materials and equipment shall be stored in areas designated by the Architect.

S. Grades, elevations and locations shown on the drawings are approximately correct; however, the Contractor shall field check and otherwise verify all such data at the site before proceeding with the work. The Contractor shall make necessary survey equipment available at all times and shall make use of such equipment wherever necessary to properly install his equipment.

T. The Contractor shall visit the site and thoroughly acquaint himself with conditions existing at the site before submitting his proposal as he will be held responsible for the installation of the work complete in every detail. The Contractor shall especially review the phasing schedule and ensure compliance with this schedule.

U. All work shown on the drawings and not specifically included in the specifications shall be considered a part of the Contract work. All work included in the specifications and not specifically included on the drawings shall also be considered a part of the Contract work.

V. Carefully examine all drawings included under this Contract and drawings included under other contracts and report any discrepancies noticed to the Architect as this contractor shall be responsible for the HVAC system installation in its entirety.

W. Due to the small scale of the drawings, it is not possible to indicate all offsets, fittings, valves, dampers, access panels, and similar parts which may be required. The drawings are diagrammatic and generally indicative of the work to be installed. The Contractor shall
carefully investigate the structural and finish conditions affecting the work and arrange all work accordingly, furnishing necessary parts and equipment as may be required to meet the various conditions.

X. Contractor shall layout his work from dimensions of Architectural and Structural Drawings and actual dimensions of equipment being installed. Layouts in congested areas should not be scaled from Mechanical and Electrical Drawings. Clearances shall be provided on all sides of equipment as required for proper maintenance purposes and as required by the Department of Labor and Industry, OHSA and the National Electrical Code.

Y. The Contractor shall furnish the services of manufacturers' representatives for all equipment furnished under these Contract Documents. The amount of factory service provided by the Contractor shall be as normally recommended and furnished by the various equipment manufacturers unless specified otherwise. Testing of such systems and equipment shall be made under the direct supervision of competent authorized service representatives and the Commissioning Agent. Any and all expenses incurred by the equipment manufacturers' representatives shall be borne by the Contractor.

Z. All equipment and materials shall be manufactured in accordance with national standards established by manufacturer's associations, engineering and testing societies, such as NBMA, NEMA, ASTM, AMCA, ASME, ANSI, ACI, etc., where such standards have been established.

AA. When the installation is reported in writing by the Contractor to be complete and ready for acceptance, tests and inspection shall be made by the Contractor in the presence of the Architect and Commissioning Agent to ascertain whether it complies with the specifications and Contract, and upon its failure to do so, the Contractor shall at once remedy all defects and shortcomings and any additional tests that may be required shall be entirely at the Contractor's expense. All of the testing work shall be done when and as directed by the Architect before the system is accepted.

BB. Include any excavation and backfill as required for work included under this Contract. Work shall conform to all applicable state and local regulations governing safety provisions at excavation sites.

CC. The Architect/Engineer reserves the right to revise locations of piping, ductwork, locations of equipment, etc., within the building as long as sizes remain the same.

DD. In all cases where equipment and materials are specified in the singular or plural number, it is intended that such reference shall apply to as many such items as are required to complete the installation.

EE. Where piping, ducts, or other equipment pass through existing or new fire or smoke barrier stops, walls, floors, or ceilings, this Contractor shall furnish and install sleeves and shall thoroughly seal openings around sleeves, pipes, etc. with fire and smoke resistant materials. Materials shall be furnished by the HVAC Contractor as required to maintain the fire rating of the walls, partitions, ceilings and floors in accordance with the requirements of NFPA, the state building codes and other applicable codes.

FF. The Contractor shall properly lubricate all moving parts of equipment and appurtenances installed under this Contract.
GG. The Contractor will be responsible for the completion of all work included under this Contract and shall employ skilled and qualified tradesmen as necessary to satisfy all work and trades.

HH. Piping, ductwork, materials and equipment shall be stored in areas as coordinated with the Architect.

1.3 PERMITS, CODES AND INSPECTIONS

A. Obtain and pay for permits and inspections required by laws, ordinances, rules and regulations having jurisdiction for work included under Contract. Obtain certificates of each required inspection as construction progress dictates, and submit same to the Owner's Representative prior to acceptance of the Work.


C. Do work in accordance with all applicable requirements including but not limited to National Fire Protection Association, Underwriter's laboratories, Inc., National Electrical Code, O.S.H.A., and other regulatory bodies having jurisdiction over this class of work. Where applicable, materials and equipment shall bear stamps or seals of NFPA, UL, ASME, AMCA, NEMA, IEEE, NEC, and other recognized regulating agencies.

1.4 DEFINITIONS

A. To clarify and establish relationships for responsibility of work to be performed under this section, designations underlined in the subsequent paragraphs of this Article are defined.

B. Provide shall mean that work or equipment thus described shall be furnished and installed complete and all responsibility and costs relative thereto shall rest with designated Contractor or Subcontractor.

C. Furnish shall mean that equipment thus described shall be purchased by this Contractor or Subcontractor and delivered to job site for installation or erection under this or another contract or subcontract. Furnishing contractor shall be responsible for including installation data and competent supervision assistance to coordinate equipment or components into working and operable systems.

1. Magnitude of installation data and supervision assistance shall be as specifically stated elsewhere herein, or the minimum as interpreted by the Owner's Representative.

D. Contractor as stated herein shall mean HVAC Contractor or Subcontractor unless specifically designated as General Contractor, electrical Subcontractor, etc. If trades or sections of work are prime or sublet, the term "Contractor" shall be used as applicable to Contractor or Subcontractor as defined by the division established by the Contract Documents.

E. Contract as stated herein shall mean HVAC Contract or Subcontract unless specifically designated as General Contract, Electrical Subcontract, etc. If trades or sections of work are
prime or sublet, the term "Contract" shall be used as applicable to Contract or Subcontract as defined by the division established by the Contract Documents.

F. Inspect, Inspection, Inspector: To inspect the work of contractors means to observe the work of those contractors and/or subcontractors on all tiers responsible for implementing Consultant's plans, specifications, reports, and other instruments of professional service. An inspector has no authority or responsibility to direct any construction workers, and may not stop the work. An inspector is not responsible for, and does not have the education, training, or experience needed to affect the means, methods, sequences, or operations of construction, or safety procedures attendant thereto.

G. Accepted shall mean accepted by the Owner's Representative. Approved shall mean approved by the Owner's Representative. Equivalent shall mean equivalent approved by the Owner's Representative. Directed shall mean directed by Owner's Representative. HC or HVAC shall mean Heating, & Ventilating Contractor. PC shall mean Plumbing Contractor. EC shall mean Electrical Contractor. GC shall mean General Contractor.* NEC shall mean National Electrical Code, latest revision. AFF shall mean Above Finished Floor or Grade to centerline. FBO shall mean Furnished By Others. **"General" Contract Work may be performed by various contractors. See documents for division of responsibilities.

1.5 SHOP DRAWINGS AND SUBMITTALS

A. Refer to Architect’s specifications for submittal requirements.

B. At the close of the job, prior to final review, five (5) bound copies of operations and maintenance (O&M) manuals shall be submitted by transmittal to the Engineer for review and acceptance. In lieu of hard copy O&M manuals, the Contractor may submit two (2) copies on CD format containing PDF files. O&M manuals, regardless of format, shall include the following:

1. Equipment warranties.
2. Contractors’ warranties.
3. Parts list and manuals for all equipment.
4. Operating instructions (in writing).
5. Written instructions on maintenance and care of the systems.
6. Lubrication and recommended spare parts.

C. Prior to the installation of any equipment or materials, submit shop drawings and manufacturer's data for the items listed in the Submittal Log (Attachment A) in accordance with the Contract Documents. Submittal Log (Attachment A) shall serve as the Contractor’s checklist to assure the complete submission of all required shop drawings and manufacturer’s data. Additionally, all equipment and materials furnished as part of this Contract shall be submitted for review regardless of whether it is listed on Submittal Log (Attachment A) or not.
D. The submissions are the Contractor's documents, and the Architect's and Engineer's review or acceptance constitutes an acknowledgment that the documents have been submitted and nothing more. It is the Contractor's responsibility to check his own submissions for compliance with the Contract Documents and job conditions.

E. Any deviations from the design documents must be clearly identified so that the Engineer may properly review such items. It shall not be the Engineer's responsibility to search out these discrepancies. If such changes are not properly flagged for the Engineer's review, the Contractor shall be completely responsible for all consequences said changes might result in on the project.

F. Submit Record (As-Built) Drawings. Refer to Paragraph 3.03

1.6 SUBSTITUTIONS

A. Throughout the Specifications, types of materials may be specified by manufacturer's name and catalog number in order to establish standards of quality and performance and not for the purpose of limiting competition. Unless specifically stated otherwise, the bidder may assume the phrase "or approved equivalent," except that the burden is upon the bidder to prove such equality. If the bidder elects to prove such equality, he must request the Architect's approval in writing to substitute such item for the specified item, and shall submit supporting data, and samples if required, to permit a fair evaluation of the proposed substitution with respect to quality, serviceability and warranty. All data pertinent to the proposed substitution shall be submitted to the Architect at least 10 days prior to the bid date for evaluation and review purposes. If the Architect accepts the proposed substitution, an addendum will be issued to all bidders advising all bidders that this substitution will be acceptable from all bidders.

B. Substitutions of equipment other than that specified must be very carefully checked to assure that no problems will occur due to dimensional differences, code requirements, connection points, weights, etc. Where the Contractor elects to substitute materials or equipment approved by the Architect for those specified, the Contractor will be held responsible for all architectural, structural, mechanical, and electrical changes required for the installation of the substituted materials at no additional cost to the Owner. All tests required to substantiate the equivalence of the material will be the obligation of the Contractor.

C. When this Contractor desires to furnish equipment of a manufacturer other than that specified or intended, he shall include a complete specification of the substituted item, along with each submission copy of shop drawings, indicating the necessary modifications to the substituted product to satisfy the requirements of the Contract Specifications. Manufacturer's specifications shall be written as close as possible over the Contract Specifications and each paragraph shall bear the same paragraph number as the Contract Specifications so that close comparison can be made. All submissions will be rejected should they not include the comparison specification. Comparison specification shall be submitted for approval 10 days prior to the Bid Date. If prior approval is not obtained, no substitutions will be considered and the Engineer reimbursed for time spent to reject and return such submission.

D. The verification specification shall include the exact wording of the Contract Specification and the revised wording identified properly indicating all the deviations proposed. If no deviations are noted, the Contractor must furnish the material or equipment in accordance with the Contract Specifications.
E. Should the Contractor elect to propose a substitution after the project has been awarded, the Contractor will be billed for the time spent by the Architect and his consultants in evaluating the proposed substitution. This billing shall occur whether the proposed substitution is accepted or rejected and shall be at the rate of the direct cost to the Architect times a 2.5 multiplier.

F. The submissions are the Contractor's documents, and the Architect's and Engineer's approval constitutes an acknowledgment that the documents have been submitted and nothing more. It is the Contractor's responsibility to check his own submissions for compliance with the Contract Documents and job conditions.

1.7 QUESTIONS AND CLARIFICATIONS OF BID DOCUMENTS

A. Bidders shall not rely on any verbal clarification of the Drawings and Specifications. Any questions or clarifications shall be referred to Engineer at least seven (7) working days prior to bidding to allow for issuance of an addendum.

1.8 MECHANICAL PLANS

A. The mechanical plans are intended to be diagrammatic and are based on one (1) manufacturer's equipment. They are not intended to show every item in its exact location, the exact dimensions or all the details of the equipment. The Contractor shall verify the actual dimensions of any specified or substituted materials and equipment to ensure that they will fit in the available space. All apparatus shall be located as closely as conditions will permit and deviations there from shall be made only with the consent of the Engineer and without additional charge. The right is reserved by the Engineer to make any reasonable changes in the location of the equipment prior to rough-in without invoking additional expense. This contractor shall be responsible to create and distribute for sign-off amongst other trades ductwork and HVAC piping coordination drawings. Refer to Subsection 3.5 for further clarification.

1.9 SPECIAL ENGINEERING SERVICES

A. In the instance of Mechanical and Control systems, such as all major and special equipment, heating equipment, controls, fans, or similar miscellaneous systems and equipment, the installations, final connections and testing of such systems shall be made under the direct supervision of competent authorized service engineers who shall be employed by the respective equipment manufacturer and/or an authorized representative. Any and all expenses incurred by these equipment manufacturers' representatives shall be borne by the Contractor.

1.10 SCHEDULE OF WORK

A. The Contractor shall arrange his work to comply with the Architect’s schedule and the published or revised phasing schedule. The Contractor shall submit a complete schedule of work to the Architect for approval at the beginning of the Contract in accordance with the phasing schedule. The schedule shall clearly indicate the proposed order in which the various parts of the work will be undertaken and the estimated time required for the completion of each particular part of the work. All work shall be coordinated with work being performed by contractors of other trades, with the Owner and phasing schedule.
B. The schedule of work may be revised periodically during the course of construction, but each revised schedule must be approved by the Architect.

1.11 EQUIPMENT GUARDS

A. Equipment guards shall be provided for protection at all belts, chains, gears, motors or other moving parts of equipment and machinery installed under this Contract. Guards shall be made up of suitable structural shapes and heavy gauge steel welded together and attached to equipment by removable clips and bolts. Guards shall be neat and substantial and shall be securely attached to equipment. After fabrication, guards shall be cleaned of rust and scale and painted with one coat of metal primer followed by two coats of enamel to match the equipment. Guards shall be easily removable for maintenance and service of equipment. All equipment guards shall conform with OSHA requirements.

1.12 LOCATIONS

A. Obtain detailed and specific information regarding location of all equipment, as the final location may differ from that indicated on drawings. Relocate work improperly placed because of Contractor's failure to obtain this information and reinstall as directed, without additional expense to Owner.

B. The design is subject to such revisions as may be necessary to overcome building obstructions. No changes are to be made in location of equipment without prior written approval by Architect.

C. Owner's Representative reserves the right to change locations of equipment, diffusers, registers, thermostats, plumbing fixtures, floor drains, and other items prior to roughing-in, up to a distance of 25 feet without additional charge by the Contractor.

D. Door swings may vary from plans. Take note of actual door swings at time of rough-in. Do not install thermostats, switches or other items behind the swing of any door.

1.13 PAINTING

A. The painting of all exposed pipe, conduits, hangers, and other metal clad equipment provided under this Contract shall be the responsibility of the HVAC Contractor.

B. Factory finished equipment shall be touched up where necessary with same type, texture and color of paint as equipment was originally finished. Touch-up shall be done as directed after all work has been completed and equipment is in final location.

C. All anti-corrosive and anti-rust paints shall not exceed the VOC content limit of 250g/l as described in the LEED Reference Guide – Version 2.2 EQ Credit 4.2 - Low Emitting Materials – Paints and Coatings. All other paints used on this project shall conform to the criteria in this credit.

D. General Contractor will paint all patchwork.
1.14 MISCELLANEOUS IRON WORK

A. Furnish and install all miscellaneous iron work including, but not limited to, piping hangers, piping anchors and guides, ductwork supports, and all other equipment supports. All additional structural members shall be furnished and installed to support the heating, ventilating and air conditioning equipment without excessive stress or strain on the building construction. Structural beams and other structural members shall be furnished and installed under this Contract for anchors and guides where the building steel is not available or capable of supporting or anchoring pipe lines and equipment.

B. All equipment and materials furnished and installed under this Contract which are not mounted on bases or floors shall be securely attached and supported from the main supporting structure of the building by metal hangers, clamps and/or brackets. Metal hangers, clamps and/or brackets shall be of suitable design and of sufficient strength to properly and safely support the materials and equipment involved. Lag screws and bolts shall be used where required at wood construction.

C. Materials

1. Structural steel members for the support of equipment installed under this Contract shall conform to ASTM Specifications A 36 and shall comply with the latest requirements of the American Institute of Steel Construction. Structural steel shall be of standard sections as given in the structural steel manufacturers' handbooks.

D. Priming and Painting

1. All steel and iron work shall be primed with Rust Oleum X 60, or approved equivalent. Before priming all metal shall be thoroughly cleaned free from scale, rust, and dirt.

E. Paint final coat black on all miscellaneous steel installed under this contract by this Contractor.

F. Anchors

1. The Contractor shall provide all anchors, bolts, screws, dowels, and connecting members and do all cutting and fitting necessary to secure the work to adjoining construction. Build in connecting members to masonry, concrete, and structural steel as the new and remodeling work progresses.

G. Supports and Brackets

1. Supports and brackets shall be neatly constructed of structural shapes to adequately support the equipment intended. All supports must be approved prior to installation. Field conditions will regulate the type of support.

1.15 DRAWINGS AND SPECIFICATIONS

A. Carefully examine the drawings and specifications for architectural, structural and other Divisions and Sections of the Work. If any discrepancies occur between the drawings, or between the drawings and specifications, report such discrepancies to the Owner's Representative in writing and obtain written instructions as to the manner in which to proceed.
No departures from Contract Drawings will be made without prior written approval of Owner's Representative.

B. Report any discrepancies at least 72 hours prior to submission of a bid. Questions received less than 72 hours prior to date of bid opening will not be answered by formal written addendum. Oral and other interpretations or clarifications will be without legal effect. In the event such discrepancies are not reported and claims for extra charges to any contract result, such claims will be allocated to, and charged to, the Contractor who, in the judgment of Owner's Representative, is the responsible party.

C. In the event of questions or disputes as to intent or meaning of Contract Drawings or Specifications, an interpretation will be given by the Owner's Representative and said interpretation will be final and binding.

D. Specifications and the Drawings are not intended to define all details, finish materials, covers, fittings and special construction which may be required or necessary. Furnish, install and connect same in order to make installation complete and adequate as implied by Specifications and Drawings.

E. Drawings are diagrammatic only and do not show exact routes and locations of equipment. Familiarize yourself with the work of other contractors and arrange your work to avoid conflicts. In the event of conflict of work with existing conditions and work of any other contractor, obtain a new approved location of work from Owner's Representative.

F. Because of the small scale of the Drawings, it is not possible to indicate offsets in piping, conduit and ductwork, pipe, fittings, valves, access panels and similar items which may be required to make a complete operating system. Carefully investigate conditions affecting work and install work in such manner that interferences between pipes, ducts, conduit, equipment, architectural and structural features will be avoided and provide such offsets, fittings, access panels or valves as may be required to meet conditions at the building, and in accordance with applicable codes or governing body so as to avoid such interferences, without additional cost to the Owner.

G. Due to the magnitude of ductwork, number of other utilities, and the limited amount of ceiling space, installation of ductwork shall have precedence over other trades. H.C. shall coordinate installation of systems under his designated contract with all other contractors. H.C. shall provide "interference drawings" to be coordinated with all other contractors. After all contractors have signed off the drawings, turn over one set of prints to the Professional for their records. INSTALL NO DUCTWORK UNTIL "INTERFERENCE DRAWINGS (WITH SIGN-OFFS)" ARE DELIVERED TO AND REVIEWED BY THE PROFESSIONAL.

H. Specifications and drawings are complementary, include work shown on drawings but not specified, and vice versa, as if both shown and specified. All work shown on the drawings and not specifically included in the specifications shall be considered a part of the Contract work. All work included in the specifications and not specifically included on the drawings shall also be considered a part of the Contract work.

I. Consider work new even though no mention is made of new, unless otherwise indicated to the contrary herein or on the drawings.
J. When work has been completed and before final approval, deliver to the Owner's Representative a complete set of prints of contract drawings, properly and clearly marked in colored pencil, to show all changes made in original contract drawings and to represent the work as constructed.

K. Contractor shall layout his work from dimensions of Architectural and Structural Drawings and actual dimensions of equipment being installed. Layouts in congested areas shall not be scaled from Mechanical and Electrical Drawings. Clearances shall be provided on all sides of equipment as required for proper maintenance purposes and as required by the Department of Labor and Industry.

1.16 UTILITIES

A. Be responsible for all coordination and scheduling of construction as necessary for the performance of work under your Contract.

B. Unless otherwise indicated, be responsible for payment of all utility charges for installation/connection/on site construction for work required under your Contract.

1.17 PROTECTION

A. Effectively protect at own expense, such of work, materials or equipment as are liable to loss, damage or injury during the construction period and be held responsible for any such loss, injury or damage until work is fully and finally accepted.

B. Refer to Division 01 for additional requirements.

1.18 SKILLED MECHANICS

A. Install work under the Contract in a neat and workmanlike manner. Work which in the judgment of the Owner's Representative is not so installed: remove and replace to his satisfaction, at your expense. Do work with workmen skilled in their respective trade. Leave areas broom clean and equipment clean of dirt, rust, dust, tags and fingermarks.

1.19 TRADE NAMES

A. Trade names and manufacturer's equipment numbers are used to amplify the specifications and establish type and quality of equipment specified.

B. If substitute equipment offered for use requires material or equipment beyond that shown or required by this contract, it will be provided at Contractor's expense, regardless of trade involved.

C. Substitutions will be accepted as delineated in Division 01.

1.20 PERFORMANCE OF EQUIPMENT
A. Materials, equipment and appurtenances of any kind shown on drawings, hereinafter specified, or required for completion of the work in accordance with the intent of these specifications, will be completely satisfactory and acceptable as regards operation, performance and capacity. No approval, written or verbal, of any drawings, descriptive data or samples of such material, equipment or appurtenances will relieve you of your responsibility to turn over complete installation of heating and ventilating systems to the Owner's Representative in perfect working order and in complete conformance with Drawings and specifications at completion of the work.

B. Any material, equipment or appurtenances, the operation, capacity or performance of which does not comply with requirements of Drawings and Specifications, or which is damaged prior to acceptance by the Owner's Representative will be held to be defective material and will be removed and replaced with proper and acceptable materials, equipment and appurtenances or put in proper and acceptable working order, satisfactory to the Owner's Representative.

C. Properly lubricate moving parts of equipment and appurtenances. Start up and test them.

D. Operate equipment without objectionable noise or vibration as determined by the Owner's Representative. Should such objectionable noise or vibration be produced and transmitted to occupied portions of the building by apparatus, piping, pumps or other parts of this Work, make necessary changes as approved without cost to the Owner.

1.21 AVAILABLE SPACE

A. Be responsible for verifying dimensions of available space for equipment to be installed under this Contract, and verify dimensions of new equipment prior to delivery. After delivery of new equipment, if it is found that it does not properly fit available space, with required clearances, remove the equipment from the project site and provide equipment to fit available space, at no additional cost to Owner. Be responsible for rigging new equipment required under Contract, through the building, and provide cutting and patching of building construction for rigging of equipment to be installed under Contract, unless otherwise noted.

B. Should the proposed equipment require disassembly for entry through openings, be responsible for disassembling equipment for passage through the openings, and reassembling the equipment for installation at locations as indicated. Be responsible for proper operation and guarantee of disassembled and reassembled equipment; should equipment not operate properly or become damaged due to disassembly and reassembly, replace equipment at no additional cost to the Owner.

C. Carefully schedule delivery of equipment to project site in accordance with the Schedule of Work.

1.22 FLASHINGS

A. The Contractor shall furnish and install roof curbs as required for his equipment.

B. The Contractor shall furnish and install pipe portals for pipes as required.
C. An approved roofing sub-contractor, responsible to the Heating Contractor, shall install flashings at roof curbs and final roofing, to maintain the roof warranty.

1.23 OPENINGS IN WALLS AND ROOF

A. The appropriate Prime Contractor will furnish openings for intakes in the new exterior walls of the building. These are all located and shown on the Drawings and shall be coordinated between this Contractor and the appropriate Prime Contractor. HVAC Contractor shall furnish openings in existing walls and roof for intake and outlets. This Contractor shall coordinate location and site. Openings in existing roofs shall be the responsibility of this Contractor. Final roofing shall be by the appropriate Prime Contractor.

1.24 SOUND CRITERIA

A. Fans-Compressors – Not to exceed 80 decibels at 5 feet from any point on the unit using Sound Level Meter and Method according to ASA Z24.3.

B. Sound Pressure Levels (dB re MicroPascals) (through each octave band) of rooms shall not exceed the following:

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PART 2 - PRODUCTS

2.1 ELECTRIC MOTORS, STARTERS AND SELECTOR SWITCHES

A. Electric Motors

1. All electrical motors furnished and installed under this Contract shall be manufactured by Reliance, General Electric, U.S. Motors, or approved equivalent and shall be of the proper type and frame of the services involved in accordance with the NEMA and Equipment Manufacturer's recommendations. Motors shall be "energy efficiency" type with 1.15 service factor. Motor windings shall be all copper. Where possible, motors shall be permanently lubricated. Where motors must be lubricated, the manufacturer shall furnish the services of a representative to review the lubrication procedure with the Contractor and the Owner and turn over to both of them all of the necessary maintenance literature. Motors and installation shall conform with all applicable requirements of the National Electrical Code. Motors shall be suitable for across-the-line or reduced voltage starting as applicable in each instance. Provide the Electrical Contractor with all motor data to properly size overcurrent protection devices for all combination starters and disconnect switches. The HVAC Contractor shall be responsible for any additional costs.
to the Electrical Contractor resulting from any changes in motor sizes initiated by the HVAC Contractor, from sizes scheduled on the Drawings.

B. Manual Motor Starters

1. Manual motor starters shall be furnished by this Contractor, for installation by the Electrical Contractor, for single phase fractional horsepower (1/2 horsepower and smaller) motors. Provide all motor electrical characteristics to the Electrical Contractor so the Electrical Contractor may size wiring.

C. Magnetic Motor Starters - Full Voltage

1. Furnish to the Electrical Contractor for installation combination full voltage magnetic starters and fused disconnect switches for all 3 phase motors with service factors of 1.15. Starters shall have three (3) current overload relays and low-voltage release. Starters shall be furnished with hand-off-automatic switch, red run light, overload reset, a set of extra auxiliary contacts consisting of one (1) normally open and one (1) normally closed contacts and a control transformer with 120 volt fused secondary control circuit and fused primary circuit. Starter enclosure shall be NEMA 1 enclosures. Furnish Allen-Bradley Bulletin 512 starters or equivalent as manufactured by Square D, General Electric or Siemens. Disconnect switches shall be horsepower rated to match the horsepower of the motors plus 1.15 service factors connected thereto as required.

2. Where starters are separately mounted, they shall be of the magnetic type as herein specified.

3. All magnetic motor starters for motors connected to the normal/emergency electrical distribution system shall be provided with an adjustable time delay unit. Time delay unit shall be capable of delaying motor starting from 0 to 180 seconds.

D. Hand-Off Automatic (H.O.A.) Selector Switches

1. The ATC Contractor shall furnish and install remote hand-off-automatic selector switches where shown or required and shall be the type that can be changed in the field from two positions and vice versa. Switches shall have padlocking attachment that will permit locking in either the manual or automatic positions. Switches shall be furnished with NEMA Type 1 enclosures where installed remote from starter. Provide Cutler-Hammer three (3) position switches, padlocking attachment, or equivalent as manufactured by Square D, General Electric, or Siemens.

2. Starter for the Emergency Generator Supply Fans shall be furnished with an “off-auto” selector switch in lieu of a “hand-off-auto” selector switch as the exhaust and supply fans should operate as a pair of fans.


E. Safety Switches

1. Safety Switches shall be furnished to the Electrical Contractor for installation.
   a. Safety switches shall be of the fusible type as indicated, quick make, quick break in NEMA Type 1 sheet steel enclosure unless otherwise noted. Switches shall be horsepower rated, and of size and number of poles as indicated on the Drawings. Safety switches shall be of type having a direct mechanical linkage between contacts and operating handle. Safety switches shall be as manufactured by
Cutler-Hammer, General Electric, or Square D Company. Fuses for all switches shall be of the UL Class RKI Low Peak as manufactured by the Bussmann Mfg. Division of the McGraw Edison Company. Fuses for motors shall be sized to conform with the motor running current and in strict accordance with the recommendations of the fuse manufacturer.

b. Where switches are located at the exterior of the Building or in wet locations, they shall be provided with NEMA 3R or 4 weather tight and weather resistant enclosures. Enclosures for switches located in hazardous areas shall be of the appropriate explosion proof type.

c. Switches used as service entrance switches shall be Underwriters Laboratories listed suitable for Service Entrance Equipment.

F. The H.C. shall coordinate the starter control circuit transformer VA requirements with the ATC contractor prior to ordering starters.

G. Disconnect switches serving remotely mounted soft starters or VFD's shall be furnished with a minimum of one (1) set of normally open auxiliary contacts.

2.2 ELECTRICAL BEARING DAMAGE PROTECTION FOR MOTORS WITH VFD'S

A. General Requirements – Shaft Grounding

1. Motors operated on variable frequency drives shall be equipped with a maintenance free, conductive micro fiber, shaft grounding ring with a minimum of two rows of circumferential micro fibers to discharge damaging shaft voltages away from the bearings to ground.

2. Application Note: Motors up to 100 HP shall be provided with one shaft grounding ring installed either on the drive end or non-drive end. Motors over 100 HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor. Grounding rings shall be provided and installed by the motor manufacturer or contractor and shall be installed in accordance with the manufacturer’s recommendations.

B. General Requirements – High-Frequency Bonding:

1. Motors operated on variable frequency drives shall be bonded from the motor foot to system ground with a high frequency ground strap made of flat braided, tinned copper with terminations to accommodate motor foot and system ground connection.

2. Application Note: Proper grounding of motor frame for all inverter-driven induction motors

   a. References: ABB Technical Guide No.5
   b. Allen Bradley Publication 1770-4.1 Application Data, Industrial Automation Wiring and Grounding Guidelines

C. Recommended Parts

1. Bearing Protection Ring
2. High Frequency Ground Strap

D. Acceptable Manufacturers

23 05 06 -16 BASIC HVAC MATERIALS AND MATERIALS WCPS: Boonsboro High School Auditorium & Stage Renovations
1. Electro Static Technology-ITW  
Manufacturer of AEGIS® products.  
Phone: 207.998.5140  
Fax: 207.998.5143  
sales@est-aegis.com  
www.est-aegis.com

2.3 ACCESS PANELS

A. The HVAC Contractor shall furnish and install factory fabricated access panels for access to all concealed dampers, damper actuators valves, and other equipment where no other means of access is available. Access panels shall be of appropriate size but not less than 24" flush type, hinged to drop down and out, screwdriver operated, stainless steel in tile work and prime coated sheet steel in plaster or acoustical tile of all types. The HVAC Contractor shall furnish and install access panels for all equipment installed under this Contract. Exact locations and sizes of panels shall be determined by the HVAC Contractor, but panels shall be located for a symmetrical appearance. Access panels are not required at lift out removable tile ceilings.

B. At locations where access panels are installed in existing or new fire rated construction, access panels shall contain the 1 1/2 hour fire rated "B" label; and in addition, shall also be provided with layers of gypsum wall board in a thickness which will supply an additional one and two hour fire rating equal to the fire rating of adjacent construction.

C. Coordinate with the General Contractor on fire ratings of new and existing construction.

2.4 FIRE STOPPING

A. The following fire stopping requirements constitute minimum requirements of this specification. The Contractor shall be aware of additional requirements by the Construction Manager, which may exceed or supercede this specification.

B. Seal openings of fire rated construction with a material or product that has been tested at an independent testing laboratory, such as UL, FM, etc. Fire stopping shall conform to ASTM E 814 and UL 1479, with fire ratings equal to or exceeding the fire rating of the construction involved. Fire stopping shall be UL classified, and shall be similar to the 3M brand Fire Barrier Penetration Sealing Systems, or approved equivalent. Fire stopping of this type shall also be utilized for openings through smoke rated construction.

C. If desired by the Contractor and approved by local codes, the "Pro Set" piping penetration system also may be utilized. Penetration system shall be UL certified and shall be the "Pro Set" System A. Firestop coupling (sleeve) shall be filled with ceramic fiber material to provide insulation and fire stopping. System shall be capable of maintaining a 3 hour fire rating. Penetration system shall be secure, waterproof, fire rated, and smokeproof and shall allow for pipe expansion and contraction.

PART 3 - EXECUTION
3.1 CLEANING

A. At the completion of the work all parts of the installation shall be thoroughly cleaned. All strainers, vents, pumps, etc., shall be cleaned of all dirt. All temporary replaceable air filters shall be removed and new replaceable air filters shall be installed after the areas have been cleaned for occupancy. The system shall be operated for a sufficient period to remove all grease, metal cuttings, and other foreign matter from the system.

B. Any stoppage or any discoloration or other damage to any part of the building, its finish or furnishings due to the Contractor's failure to properly clean the piping, shall be repaired by the Contractor without cost to the Owner.

C. All hot and chilled water system piping, steam and condensate piping, condenser water piping and all glycol piping, circulating pumps, boilers and water passages shall be cleaned as indicated in the following sections:
   1. 232510 Closed Loop Water Treatment
   2. 232520 Cooling Tower Water Treatment
   3. 232530 Glycol Piping Treatment

D. All new equipment installed under this Contract, existing remaining equipment, and new and existing furnishings and finishes soiled or damaged due to the work included under this Contract shall be thoroughly cleaned as required to remove plaster, dust, paint splashes, labels and debris.

3.2 INSTRUCTIONS TO OPERATING PERSONNEL

A. The Contractor and his subcontractors shall satisfactorily complete the systems so that they are functional and operating to the satisfaction of the Architect and Commissioning Agent. All systems, their controls and their sequencing must be demonstrated to the satisfaction of the Architect and Commissioning Agent.

B. The Contractor shall furnish the services of qualified personnel, approved by the Architect and thoroughly familiar with the completed installation to instruct the permanent operating personnel in the proper operation of all systems included under this Contract and the proper care of all equipment and apparatus. These services shall be furnished for a period of five 8 hour days after the operation of the building has been taken over by the Owner.

C. When instructions are provided under this Contract, the Contractor shall have in his possession three copies of an identifying letter which shall list the names of the Contractor's qualified instruction personnel including manufacturers' representatives and subcontractors that will be giving instructions. Likewise on the same letter, spaces shall be provided for the Owner's personnel who will receive the instructions. After instructions have been given and received for each system, the Contractor's representatives and subcontractors shall sign and date the letter, and the Owner's personnel shall sign and date the letter acknowledging that they have received adequate instructions for operating and maintaining the systems and equipment. One signed copy shall be delivered to the Owner, one copy to the Architect, and one copy shall be retained by the Contractor.

D. In addition to the verbal instructions outlined above, the Contractor and his manufacturers' representatives and subcontractors shall furnish written basic instructions indicating the proper
operation of each system and associated equipment. Each manufacturer shall also submit a brochure on his equipment including instructions on operation, lubrication, recommended spare parts, and instructions on preventative, routine, and breakdown maintenance. All brochures and formats must be approved by the Architect.

E. The Contractor shall combine the written instructions and the manufacturers’ equipment brochures in complete volumes with hard back binders which shall be turned over to the Owner before final acceptance of the Contract work. The Contractor shall furnish the Owner with three (3) complete sets of the manuals indexed by equipment and by manufacturer. The Contractor shall obtain two copies of a signed receipt from the Owner for the written instructions and equipment brochures. One copy of the receipt shall be delivered to the Architect and one copy retained by the Contractor.

F. It is the intent that this entire system with its complement of equipment and auxiliary equipment operate properly in accordance with the design concept and functional intent. It is also the intent that the Owner be given complete instructions for the proper operation and maintenance of the entire system.

3.3 RECORD (AS-BUILT) DRAWINGS

A. The Contractor shall maintain a complete set of Contract Drawings at the site and shall record all deviations in his work (in red ink or pencil) from that indicated on the Contract Drawings. Deviations shall be clearly and accurately recorded so that the Engineer can prepare final record (as-built) drawings using the Contractor’s marked-up drawings. Dimensions shall be recorded using permanent reference points such as columns, building walls and like items. Of particular importance are the locations of all interior and exterior underground utilities. These record drawings shall be submitted to the Architect prior to final acceptance.

3.4 WARRANTY

A. The Contractor shall warrant that the materials and workmanship used in the erection of this installation are as herein specified, and he shall provide all labor and materials required to make good any defects in same which become apparent within one year from date of acceptance of completed work providing such defects are due to faulty materials or workmanship and not to misuse of apparatus by the Owner, his employees, or tenants. Certain equipment shall be warranted or guaranteed for longer than one year from date of final acceptance where specifically mentioned in these specifications.

B. The equipment and materials manufacturers are expected to recognize that they are responsible for the failure of their products to perform in accordance with data furnished by them or their authorized representatives as well as misrepresentations of such data. When the products have been installed in accordance with the manufacturer’s published or written instructions and recommendations and such products fail, then the Contractor and the manufacturers are responsible for replacement of the products and all associated work and materials without additional cost to the Owner. This warranty applies to all items supplied on the equipment and not just those that are the product of the manufacturer.

3.5 COORDINATION DRAWINGS
A. Coordination

1. Each Contractor shall familiarize himself with the drawings and specifications of all other contracts relating to this project and shall coordinate with, and be held responsible for his Work which is affected by or dependent on, other contracts.

2. Each Contractor shall provide any dimension, coordination, sleeve, insert, embedded or built-in item, and/or information which is required to be built into, or to complete, the work of another contract in a manner consistent with the Approved Project Schedule. Any additional cost or delay damages arising from a contractor’s failure to so furnish or provide shall be borne by that contractor.

B. Coordination Drawings and Procedures

1. Each Contractor shall prepare composite shop drawings and field installation layouts for his work as directed by the Architect to solve tight field conditions except as modified in Paragraph 3 below. Such drawings shall consist of dimensioned plans and elevations and shall give complete information, particularly to size and location of sleeves, attachments, openings, conduits, ducts, boxes and structural interferences.

2. These composite shop drawings and field installation layouts shall be coordinated in the field among the Contractors to verify the proper relationship to the work of other Contractors based on field conditions, and shall be checked for accuracy and approved by the Contractors as directed by the Architect before submission to the Architect for his final approval.

3. HVAC, Plumbing, Fire Protection and Electrical Work shall be coordinated as indicated by the following procedure. Each Contractor shall sign each coordination drawing after all work has been laid out and conflicts resolved. The preparation of coordination drawings and layout Work on the coordination drawings shall be performed at the site by each Contractor.
   a. The HVAC Contractor shall prepare a CAD drawing of each area, at a scale of ¼” inch equal 1'-0", showing his work plan and elevation. The Architect/Engineer can provide CAD Backgrounds of the entire project to the HVAC Contractor for his use. The HVAC Contractor shall layout and show light fixtures on the drawings.
   b. The CAD Drawings referred to in 3. a. above shall then be forwarded to the next succeeding Contractor for layout of their work in the field in the following order; (a) PLUMBING AND FIRE PROTECTION; (b) ELECTRICAL; (c) INTERIOR CONSTRUCTION.
   c. By use of color coding, and layering each succeeding Contractor shall show his work on the referenced CAD Drawing and shall sign same to indicate his satisfaction that there is no interference between his work and that of other Contractors. Colors will be assigned by the Architect.
   d. When all work has been shown and signed off, the HVAC Contractor shall forward each CAD Drawings to the Architect, for review and approval. Prints of approved CAD Drawings shall be distributed to the Contractors by the Architect.
   e. The Architect shall print one copy for each trade for use in the field.
   f. The color coded transparency shall be kept at the Architect’s field office for future reference in the event of conflict between the trades. At the completion of the project, all color coded transparencies shall be delivered to the Owner for his records.
   g. No installation work will proceed until ALL contractors have signed off and agreed to the coordination drawings.
C. Meetings

1. Coordination meetings to resolve interferences in the Work will be held at the site in an area to be provided by the Architect. Representatives of each Contractor shall be present at each meeting. Each Contractor shall provide all necessary resources to insure that the coordination process described herein does not delay the Approved Project Schedule.

D. Each Contractor acknowledges that there may be items of Work which have not been drawn, coordinated, clarified or specified with complete detail in the Contract Documents but which are required for the completion of the Work, as inferable from the Contractor Documents. Any such item, when identified as part of the development of the Work, shall be drawn, coordinated, clarified or specified by the Architect in a manner consistent with contemplated kind, quality and customary standards and provided to the Contractor. When such drawing, coordination, clarification or specification is approved by the Owner, the drawing, coordination, clarification or specification so approved shall thereupon be part of the Contract Documents and the item of Work shall be performed by the Contractor as part of the Work without further action or order of the Owner and without any increase in the Contract amount or time as if such drawing, coordination, clarification or specification were originally included in the Contract Documents.

3.6 MERCURY PROHIBITION

A. The use of mercury as a component of any equipment installed as part of this work is strictly prohibited. Where required, mercury substitutes shall be used in thermometers, thermostats, switches, and other equipment, which might commonly contain mercury.

3.7 WARRANTY

A. The Contractor shall warrant that the materials and workmanship used in the erection of this installation are as herein specified, and he shall provide all labor and materials required to make good any defects in same which become apparent within one year from date of final payment providing such defects are due to faulty materials or workmanship and not to misuse of apparatus by the Owner, his employees, or tenants. Certain equipment shall be warranted or guaranteed for longer than one year from date of final payment where specifically mentioned in these specifications.

B. The equipment and materials manufacturers are expected to recognize that they are responsible for the failure of their products to perform in accordance with data furnished by them or their authorized representatives as well as misrepresentations of such data. When the products have been installed in accordance with the manufacturer's published or written instructions and recommendations and such products fail, then the Contractor and the manufacturers are responsible for replacement of the products and all associated work and materials without additional cost to the Owner. This warranty applies to all items supplied on the equipment and not just those that are the product of the manufacturer.

3.8 CUTTING AND PATCHING

A. New Construction
1. Except where indicated otherwise, General Contractor will construct all chases and recesses, bulkheads and openings through roof and walls in new construction to accommodate work to be placed under this Contract. Contractor shall locate and size all openings and set sleeves when requested so as not to delay work of the General Contractor. Final responsibility for placement and suitability of such chases, openings and recesses shall rest with this Contractor.

2. Interior openings not located before walls are in place shall be cut at this Contractor's expense. All patching made necessary by said cutting shall be at this Contractor's expense. All holes required after masonry is in place shall be made with a rotary drill and shall be drilled between ribs, beams or joist spacing.

B. Existing Construction

1. All openings in completed new work and in existing walls or ceilings of existing building construction required to install work under Contract shall be cut by this Contractor, except openings in existing exterior walls and existing roofs which shall be cut by the General Contractor. All rough patching made necessary by Contractor's cutting shall be this Contractor's responsibility and shall be performed by workmen skilled in the respective trades. Surfaces of patchwork shall match adjacent existing construction subject to approval of Owner's Representative. Holes required through existing walls shall be cut with a core drill and shall be drilled between ribs, beams or joists. Finish patching will be by General Contractor.

2. Coordinate location of equipment, sleeves and raceways with other contractors.

3. Rough patch all openings in existing construction created by Contractor, caused by removal of existing equipment, and associated materials under Contract, except openings in existing roofs which shall be patched by General Contractor. Finish patching will be by General Contractor.

C. Smoking shall be prohibited inside the building and within 25 feet of building entrances.

END OF SECTION
**SUBMITTAL LOG (ATTACHMENT A)**

*Project Name: ________________________________*

*CJL Project No.: ___________________ Trade: ____________________________*

*Engineer’s Review: A = Reviewed, B = Rejected, C = Furnish as Corrected, D = Comments Attached*

*Contractor’s Required Response: E = Confirm, F = Resubmit*

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**SUBMITTAL LOG (ATTACHMENT A)**

Project Name: ____________________________________________________________

CJL Project No.: _____________________ Trade: ________________________________

**Engineer’s Review:**  A = Reviewed, B = Rejected, C = Furnish as Corrected, D = Comments Attached

**Contractor’s Required Response:**  E = Confirm, F = Resubmit

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PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes solid-state, pulse-width modulated (PWM), variable frequency controllers (VFDs) for speed control of three-phase, squirrel-cage induction motors.

1.2 SUBMITTALS
A. Product Data: For each type of VFD.
B. Manufacturer Qualification Certification: Submit certification that VFDs, accessories, and components will withstand forces defined in Division 26 Section "Vibration Controls for Electrical Systems."
C. Field quality-control test reports.
D. Operation and maintenance data.
E. Load-current and overload-relay heater list.
F. Load-current and list of settings of adjustable overload relays.

1.3 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.
B. Comply with NFPA 70.
C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFDs, minimum clearances between VFDs, and adjacent surfaces and other items. Comply with indicated maximum dimensions and clearances.

1.4 PROJECT CONDITIONS
A. Environmental Limitations: Rate equipment for continuous operation, capable of driving full load without derating, under the following conditions, unless otherwise indicated:
   1. Ambient Temperature: 0 to 40 deg C.
   2. Humidity: Less than 90 percent (noncondensing).
   3. Altitude: Not exceeding 3300 feet.
1.5 COORDINATION

A. Coordinate features of VFDs, installed units, and accessory devices with pilot devices and control circuits to which they connect.

B. Coordinate features, accessories, and functions of each VFD and each installed unit with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

C. Refer to Section 230513 “Motor Requirements and Electrical Devices for HVAC Equipment” for bearing damage protection for motors with VFD’s.

1.6 WARRANTY

A. Provide a three year warranty, with all parts and labor included, for each drive provided.

B. Provide a three year warranty on each electric motor controlled by a variable frequency drive provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. ABB Power Distribution, Inc.; ABB Control, Inc. Subsidiary
   2. Yaskawa America, Inc.
   3. Eaton/Cutler Hammer
   4. Danfoss
   5. Toshiba International
   6. Siemens

2.2 VARIABLE FREQUENCY DRIVES

A. Description: NEMA ICS 2, IGBT, PWM, VFD; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, 3-phase induction motor by adjusting output voltage and frequency.

   1. Provide unit suitable for operation of standard and premium efficiency motors as defined by NEMA MG 1.

B. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

C. Output Rating: 3-phase; 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.
D. Unit Operating Requirements

1. Input ac voltage tolerance of 380 to 500 V, plus or minus 10 percent.
2. Input frequency tolerance of 50/60 Hz, plus or minus 6 percent.
3. Minimum Efficiency: 96 percent at 60 Hz, full load.
5. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
6. Starting Torque: 100 percent of rated torque or as indicated.
7. Speed Regulation: Plus or minus 1 percent.

E. Isolated control interface to allow controller to follow control signal over an 11:1 speed range.

1. Electrical Signal: 4 to 20 mA at 24 V or 0-10VDC.
2. Pneumatic Signal: 3 to 15 psig (must be available as a factory option if required by BAS).

F. Internal Adjustability Capabilities

1. Minimum Speed: 5 to 25 percent of maximum rpm.
2. Maximum Speed: 80 to 100 percent of maximum rpm.
3. Acceleration: 2 to a minimum of 22 seconds.
4. Deceleration: 2 to a minimum of 22 seconds.
5. Current Limit: 50 to a minimum of 110 percent of maximum rating.

G. Self-Protection and Reliability Features

1. Input transient protection by means of surge suppressors.
2. Under- and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
5. Instantaneous line-to-line and line-to-ground overcurrent trips.
7. Reverse-phase protection.
8. Short-circuit protection.

H. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.

I. Power- Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped.

J. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
K. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

L. Input Line Conditioning
   1. The VFDs shall include built-in 5% line impedance.
   2. The VFDs shall include EMI/RFI filters. The onboard RFI filter shall allow the entire VFD assembly to be CE Marked and the VFD shall meet product standard EN 61800-3 for the First Environment restricted. No Exceptions.

M. Total Harmonic Distortion (THD) Compliance
   When specified VFD's are being connected to a "New" power distribution system the Mechanical Contractor shall obtain, from the Electrical Engineer, the Project's power distribution single line diagram and both primary and distribution transformer data and furnish this information/drawings to the VFD manufacturer. The VFD manufacturer shall provide out an analysis of the system. Where specified VFD's are being connected to an "Existing" power distribution system the Mechanical Contractor shall arrange and pay for the harmonic testing of the power distribution panelboard/switchboard indicated as serving the VFD's and provide a report to the VFD manufacturer for analysis of the system. The analysis shall review the potential for the proposed equipment, and any existing equipment, to meet IEEE 519 (tables 10.2 and 10.3) recommendations at the Point of Common Coupling (PCC). The result of the analysis shall determine if additional power quality improvement measures should be included in the proposal to meet the THD recommendations of IEEE 519. Any power quality improvement measures shall be provided by the Mechanical Contractor.

N. Status Lights: Door-mounted LED indicators shall indicate the following conditions:
   1. Power on
   2. Run
   3. Overvoltage
   4. Line fault
   5. Overcurrent
   6. External fault


P. Indicating Devices: Meters or digital readout devices and selector switch, mounted flush in controller door and connected to indicate the following controller parameters:
   1. Output frequency (Hz)
   2. Motor speed (rpm)
   3. Motor status (running, stop, fault)
   4. Motor current (amperes)
   5. Motor torque (percent).
   6. Fault or alarming status (code)
   7. PID feedback signal (percent)
   8. DC-link voltage (VDC)
9. Set-point frequency (Hz)
10. Motor output voltage (V)
11. VFD unit shall include the following meters to estimate use of energy
   a. Elapsed Time Meter
   b. Kilowatt Meter
   c. Kilowatt Hour Meter

Q. Control Signal Interface

1. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BMS or other control systems.
   a. 0 to 10-V dc.
   b. 0-20 or 4-20 mA.
   c. Potentiometer using up/down digital inputs.
   d. Fixed frequencies using digital inputs.
   e. RS485.
   f. Keypad display for local hand operation.

3. Output Signal Interface
   a. A minimum of 1 analog output signal (0/4-20 mA or 0-10VDC), which can be programmed to any of the following:
      1) Output frequency (Hz).
      2) Output current (load).
      3) DC-link voltage (VDC).
      4) Motor torque (percent).
      5) Motor speed (rpm).
      6) Set-point frequency (Hz).

4. Remote Indication Interface: A minimum of 2 dry circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
   a. Motor running.
   b. Set-point speed reached.
   c. Fault and warning indication (overtemperature or overcurrent).
   d. PID high- or low-speed limits reached.

R. Communications: Provide BACnet (BTL Certified) for RS-485 communication interface allowing VFD to be used with an external system within a multidrop LAN configuration. Interface shall allow all parameter settings of VFD to be programmed via BMS control. Provide capability for VFD to retain these settings within the nonvolatile memory.

S. Manual Bypass: Magnetic contactor arranged to safely transfer motor between controller output and bypass controller circuit when motor is at zero speed. Controller-off-bypass selector switch sets mode, and indicator lights give indication of mode selected. Unit shall be capable of stable operation (starting, stopping, and running), with motor completely disconnected from controller (no load).

T. Bypass Controller: NEMA ICS 2, full-voltage, nonreversing enclosed controller with across-the-line starting capability in manual-bypass mode. Provide motor overload protection under
both modes of operation with control logic that allows common start-stop capability in either mode.

U. Integral Disconnecting Means: **NEMA KS 1, fusible switch** with lockable handle.

V. Isolating Switch: Non-load-break switch arranged to isolate VFD and permit safe troubleshooting and testing, both energized and de-energized, while motor is operating in bypass mode.

W. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.

2.3 ACCESSORIES

A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.

B. Push-Button Stations, Pilot Lights, and Selector Switches: **NEMA ICS 2, heavy-duty type**.

C. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.

D. Control Relays: Auxiliary and adjustable time-delay relays.

E. Standard Displays

1. Output frequency (Hz)
2. Set-point frequency (Hz)
3. Motor current (amperes)
4. DC-link voltage (VDC)
5. Motor torque (percent)
6. Motor speed (rpm)
7. Motor output voltage (V)

F. Historical Logging Information and Displays

1. Real-time clock with current time and date.
2. Running log of total power versus time.
3. Total run time.
4. Fault log, maintaining last four faults with time and date stamp for each.

G. Current-Sensing, Phase-Failure Relays for Bypass Controller: Solid-state sensing circuit with isolated output contacts for hard-wired connection; arranged to operate on phase failure, phase reversal, current unbalance of from 30 to 40 percent, or loss of supply voltage; with adjustable response delay.

2.4 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to VFDs before shipping.
PART 3 - EXECUTION

3.1 APPLICATIONS
A. Select features of each VFD to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; and duty cycle of motor, controller, and load.
B. Select horsepower rating of controllers to suit motor controlled.

3.2 INSTALLATION
A. Install VFDs on concrete bases.
B. Comply with mounting and anchoring requirements specified in Division 26 Section "Hangers and Supports for Electrical Systems."
C. Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Division 26 Section "Fuses."

3.3 IDENTIFICATION
A. Identify VFDs, components, and control wiring according to Division 26 Section "Identification for Electrical Systems."
B. Operating Instructions: Frame printed operating instructions for VFDs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFD units.

3.4 CONTROL WIRING INSTALLATION
A. Install wiring between VFDs and remote devices according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
B. Bundle, train, and support wiring in enclosures.
C. Connect hand-off-automatic switch and other automatic-control devices where applicable.

1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
2. Connect selector switches with control circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.
3.5 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed controller element, bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:

1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Assist in field testing of equipment.

C. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection, except optional tests, stated in NETA ATS. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.6 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

B. The VFD controller shall be subject to but not limited to the following quality assurance controls, procedures and tests:

1. VFD power transistors, SCR's and diodes shall be tested to insure correct function and highest reliability. These tests will include elevated temperature functional tests, A-C and CD-C parameter tests, and high temperature reverse bias loading tests for drift and power cycling.
2. Integrated circuits shall undergo functional and reliability tests. Tests shall include 168 hour burn-in screening at 145°C according to MIL-STD-8813B, stabilization baking and temperature cycling from 150°C to-40°C, full elevated temperature, functional testing and A-C and D-C parameter testing.
3. Small signal semi-conductors shall be lot sampled high temperature reverse bias per MIL-STD-105D (1%AQL). The total lot shall then be tested for parametric and functional specifications.
4. All SCR device assemblies of individual heat sink construction will be electronically curve traced. Each assembly shall be loaded to 125% of its rated full load amperes and run for five minutes. Voltage drop tests shall then be made for minute resistance changes at conductive surfaces.
5. Electronic printed circuit board assemblies shall be tested for continuity of foils and correct components before they are functionally tested. They will be temperature cycled for 24 hours between 5°C and 85°C. The circuit assemblies shall then be functionally tested using state-of-the-art computerized test systems. Provide spare circuit board.
6. All stocked, electrical subassemblies shall be functionally tested so they can be used as tested replacement parts directly out of stock. Untested replacement parts are unacceptable.

7. Every VFD shall be functionally tested under motor load and then cycled under load. This ensures that if the VFD is started up according to the instruction manual provided, the unit will run reliably.

8. The time period of the cycling under load is determined by the previous history of test results for the product.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Thermometers
2. Thermowells
3. Pressure Gages
4. Gage Attachments
5. Flowmeters
6. Thermal-Energy Meters

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Wiring Diagrams: For power, signal, and control wiring.
C. Product certificates.
D. Operation and maintenance data.

1.3 ENVIRONMENTAL REQUIREMENTS

A. Do not install instrumentation when areas are under construction.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Miljoco Corporation
2. Trerice, H. O. Co.
3. Weiss Instruments, Inc.
4. Weksler Instruments Operating Unit: Dresser Industries; Instrument Division

B. Case: Liquid-filled and sealed type(s); stainless steel with 3” nominal diameter.

C. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings and scales in degree F.
D. Connector Type(s): Union joint, adjustable angle.
E. Connector Size: 1/2", with ASME B1.1 screw threads.
F. Stem: 0.25 or 0.375" in diameter; stainless steel.
G. Window: plastic.
H. Ring: Stainless steel.
I. Element: Bimetal coil.
J. Pointer: Dark-colored metal.
K. Accuracy: Plus or minus 1.5 percent of scale range.

2.2 LIQUID-IN-GLASS THERMOMETERS
A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Miljoco Corporation
      b. Trerice, H. O. Co.
      c. Weiss Instruments, Inc.
      d. Weksler Instruments Operating Unit: Dresser Industries; Instrument Division
   2. Case: Cast aluminum or brass; 7" nominal size unless otherwise indicated.
   3. Tube: Glass with magnifying lens and blue or red organic liquid.
   4. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.
   5. Window: plastic.
   6. Stem: Aluminum or brass.
      a. 3-1/2" stem with type 304 stainless steel sockets for liquids.
      b. 12" stem for air in general, 6" stems for ducts shallower than 12".
   7. Connector: adjustable type, 360 degrees in horizontal plane, with locking device. Rigid, angle type.
   8. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.3 THERMOWELLS
A. Thermowells
   1. Manufacturers: same as manufacturer of thermometers being used.
   2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
   3. Insertion Length: Length required to match thermometer bulb or stem.
2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Miljoco Corporation
   b. Trerice, H. O. Co.
   c. Weiss Instruments, Inc.
   d. Weksler Instruments Operating Unit: Dresser Industries; Instrument Division

3. Case: Liquid-filled type; cast aluminum or drawn steel; 4-1/2" nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
10. Ring: Metal.
11. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.
12. Vacuum-pressure range: 30 in. HG of vacuum to 15 psig of pressure.
13. Range for fluids under pressure: two times operating pressure with 10 psi intervals.

B. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Miljoco Corporation
   b. Trerice, H. O. Co.
   c. Weiss Instruments, Inc.
   d. Weksler Instruments Operating Unit: Dresser Industries; Instrument Division

2. Case: Liquid-filled and Sealed type; cast aluminum or drawn steel; 4-1/2" nominal diameter with flange and holes for panel mounting.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
8. Window: plastic.
9. Ring: Stainless steel
10. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

2.5 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.

B. Syphons: Loop-shaped section of brass pipe with NPS 1/4 pipe threads.
C. Valves: Brass or stainless-steel needle, with NPS 1/4, ASME B1.20.1 pipe threads.

2.6 FLOWMETERS

A. Pitot-Tube Flowmeters

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ABB; Instrumentation and Analytical
   b. Emerson Process Management; Rosemount
   c. Meriam Process Technologies
   d. Preso Meters; a division of Racine Federated Inc.
   e. TACO Incorporated
   f. Veris Industries, Inc.

2. Description: Flowmeter with sensor and indicator.

3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.

4. Sensor: Insertion type; for inserting probe into piping and measuring flow directly in gallons per minute.
   a. Design: Differential-pressure-type measurement for water.
   b. Construction: Stainless-steel probe of length to span inside of pipe, with integral transmitter and direct-reading scale.
   d. Minimum Temperature Rating: 250 deg F.

5. Indicator: Hand-held meter; either an integral part of sensor or a separate meter.

6. Integral Transformer: For low-voltage power connection.

7. Accuracy: Plus or minus 3 percent.


9. Operating Instructions: Include complete instructions with each flowmeter.

B. Venturi Flowmeters

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ABB; Instrumentation and Analytical
   b. Gerand Engineering Co.
   c. Hyspan Precision Products, Inc.
   d. Preso Meters; a division of Racine Federated Inc.
   e. S. A. Armstrong Limited; Armstrong Pumps Inc.
   f. Victaulic Company

2. Description: Flowmeter with calibrated flow-measuring element, hoses or tubing, fittings, valves, indicator, and conversion chart.

3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.

   a. Design: Differential-pressure-type measurement for [gas] [oil] [steam] [water].
   b. Construction: Bronze, brass, or factory-primed steel, with brass fittings and attached tag with flow conversion data.
d. Minimum Temperature Rating: 250 deg F.
e. End Connections for NPS 2 and Smaller: Threaded.
f. End Connections for NPS 2-1/2 and Larger: Flanged or welded.
g. Flow Range: Flow-measuring element and flowmeter shall cover operating range of equipment or system served.
5. Permanent Indicators: Meter suitable for wall or bracket mounting, calibrated for connected flowmeter element, and having 6" diameter, or equivalent, dial with fittings and copper tubing for connecting to flowmeter element.
   a. Scale: Gallons per minute.
   b. Accuracy: Plus or minus 1 percent between 20 and 80 percent of scale range.
6. Portable Indicators: Hand-held, differential-pressure type, calibrated for connected flowmeter element and having two 12-foot hoses, with carrying case.
   a. Scale: Gallons per minute.
   b. Accuracy: Plus or minus 2 percent between 20 and 80 percent of scale range.
7. Display: Shows rate of flow.
9. Operating Instructions: Include complete instructions with each flowmeter.

2.7 DIFFERENTIAL PRESSURE GAGES

A. Provide differential pressure gages as indicated on the drawings. Differential pressure gages shall be Bourdon tube type, 6" diameter. Case shall be aluminum, Bourdon tube material shall be bronze, ring aluminum threaded, black epoxy; bronze geared movement; baked enamel metal dial; and adjustable micrometer pointer. "O" shall be located in center. Range for gages shall be 100-0-100 with 20 psi figure intervals and 2 psi intermediate graduations. Differential pressure gages shall be Model 1125A as manufactured by Dresser Industries, Inc., or equivalent.

2.8 PRESSURE AND TEMPERATURE TEST STATIONS

A. Provide combination pressure and temperature taps on piping systems as indicated on drawings and piping details. Pressure and temperature taps shall consist of a 1/4" NPT fitting to receive either a 1/8" diameter pressure or temperature probe. Each fitting shall be solid brass with two (2) leaktight valve cores of Nordel suitable for a temperature of 275°F and a pressure rating of 1000 psig. Each fitting shall be complete with color coded sealing cap with gasket and shall be as manufactured by Peterson Engineering Co., or equivalent. This Contractor shall deliver to Owner a separate test kit consisting of:

1. 0-100 psi, 0-230 foot of water pressure gage with a No. 500 gage adaptor attached; a 25° to 125°F testing thermometer; a 0° to 220°F pocket testing thermometer; a No. 500 gage adaptor and a protective carrying case.

B. Fittings shall be capable of passing a non-leakage test by a recognized testing laboratory for a minimum of 80 insertions during a 5 day period at a pressure of 100 psig and a temperature of 240°F. A certified report shall be submitted, if required by the Owner's Representative.

2.9 FILTER DIFFERENTIAL PRESSURE GAGES
A. Provide F.W. Dwyer No. 2000 magnehelic air filter gage with a range of 0 to 2" H₂O at each filter. Provide diaphragm actuated gages with: 4" diameter white dial with black figures and graduations, pointer zero adjustment with two static pressure tips, fittings for metal tubing and means for mounting each gage. Attach nameplate to filter with instructions to change filter media at 0.70" H₂O. Provide sufficient clearance at access doors for access to filters.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending a minimum of 2" into fluid and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.

H. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

I. Install remote-mounted pressure gages on panel.

J. Install valve and snubber in piping for each pressure gage for fluids (except steam).

K. Install valve and syphon fitting in piping for each pressure gage for steam.

L. Install flow indicators in piping systems in accessible positions for easy viewing.

M. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.

N. Install flowmeter elements in accessible positions in piping systems.

O. Install differential-pressure-type flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.

P. Install permanent indicators on walls or brackets in accessible and readable positions.

Q. Install connection fittings in accessible locations for attachment to portable indicators.
R. Mount thermal-energy meters on wall if accessible; if not, provide brackets to support meters.

S. Install thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler.
3. Inlet and outlet of each chiller/condenser.
4. Inlet and outlet of each hydronic coil in air-handling units.
5. Inlet and outlet of each hydronic heat exchanger.
6. Inlet and outlet of each thermal-storage tank.
7. Outside-, return-, supply-, and mixed-air ducts (at respective air handling units).
10. Boiler water sampler and deaerator water sampler discharge lines.
11. Fuel oil line to each burner.
12. Exhaust ducts for heat recovery units.

T. Install pressure gages in the following locations:

1. High pressure and low pressure side of each pressure-reducing valve.
2. Inlet and outlet of each chiller, chilled-water and condenser-water connection.
3. Suction and discharge of each pump.
4. Each steam boiler.
5. At blowoff tank.
6. Gas, fuel oil and air lines at each combination burner.
7. At deaerator heating compartment and inlet/outlet piping in condensate transfer piping.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

B. Connect flowmeter-system elements to meters.

C. Connect flowmeter transmitters to meters.

D. Connect thermal-energy meter transmitters to meters.

3.3 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping: 0 to 100°F with 5-degree scale divisions.

B. Scale Range for Condenser-Water Piping: 0 to 160°F with 10-degree scale divisions.
C. Scale Range for Heating, Hot-Water Piping: 30 to 240°F with minimum 10-degree scale divisions.

D. Scale Range for Steam and Steam-Condensate Piping: 30 to 240°F with 10-degree scale divisions.

E. Scale Range for Air Ducts: Minus 40 to plus 160°F with 2-degree scale divisions.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping: 0 to 160 psi.

B. Scale Range for Condenser-Water Piping: 0 to 160 psi.

C. Scale Range for Heating, Hot-Water Piping: 0 to 160 psi.

D. Scale Range for High Pressure Steam Piping: 0 to 200 psi.

E. Scale Range for Low Pressure Steam Piping: 0 to 30 psi.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Valves

B. Related Sections Retain Sections in subparagraphs below that contain requirements Contractor might expect to find in this Section but are specified in other Sections.

1. Division 23 Section "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.2 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.3 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to HVAC valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Ball valves, butterfly valves, plug cocks and other valves that impede the installation of insulation shall be provided with stem extensions to prevent condensation on cold surfaces, unless condensation falls into a condensate pan.

D. Manufacturer's name and number shall appear on valve directory or on a metal tag attached to valve.
E. For valves in lines 2" and smaller, use threaded or solder ends; for valves in lines 2-1/2 and larger, use tapped lug bodies.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

H. Valve-End Connections

1. Solder Joint: With sockets according to ASME B16.18.
2. Threaded: With threads according to ASME B1.20.1.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Conbraco Industries, Inc.; Apollo Valves
   b. Crane Co.; Crane Valve Group; Crane Valves
   c. Milwaukee Valve Company
   d. NIBCO Inc.
   e. Red-White Valve Corporation
   f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description
   a. Standard: MSS SP-110
   b. SWP Rating: 150 psig
   c. CWP Rating: 600 psig
   d. Steam Rating: 125 psig
   e. Body Design: Two piece
   f. Body Material: Bronze
   g. Ends: Threaded
   h. Seats: PTFE or TFE
   i. Stem: Bronze
   j. Ball: Chrome-plated brass
   k. Port: Full

B. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Conbraco Industries, Inc.; Apollo Valves
   b. Crane Co.; Crane Valve Group; Crane Valves
   c. Milwaukee Valve Company
d. NIBCO Inc.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description
   a. Standard: MSS SP-110
   b. SWP Rating: 150 psig
   c. CWP Rating: 600 psig
   d. Body Design: Two piece
   e. Body Material: Bronze
   f. Ends: Threaded
   g. Seats: PTFE or TFE
   h. Stem: Stainless steel
   i. Ball: Stainless steel, vented
   j. Port: Full

2.3 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.; Crane Valve Group; Jenkins Valves
      b. Crane Co.; Crane Valve Group; Stockham Division
      c. Milwaukee Valve Company
      d. NIBCO Inc.
      e. Powell Valves
      f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   2. Description
      a. Standard: MSS SP-80, Type 3
      b. CWP Rating: 200 psig
      c. Body Design: Horizontal flow
      d. Body Material: ASTM B 62, bronze
      e. Ends: Threaded
      f. Disc: Bronze

B. Class 150, Bronze Swing Check Valves with Bronze Disc
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.; Crane Valve Group; Jenkins Valves
      b. Crane Co.; Crane Valve Group; Stockham Division
      c. Milwaukee Valve Company
      d. NIBCO Inc.
   2. Description
      a. Standard: MSS SP-80, Type 3
      b. CWP Rating: 300 psig
      c. Body Design: Horizontal flow
      d. Body Material: ASTM B 62, bronze
      e. Ends: Threaded
      f. Disc: Bronze
2.4 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Crane Co.; Crane Valve Group; Stockham Division
   b. Milwaukee Valve Company
   c. NIBCO Inc.
   d. Powell Valves
   e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description
   a. Standard: MSS SP-80, Type 1
   b. CWP Rating: 200 psig
   d. Ends: Threaded or solder joint
   e. Stem and Disc: Bronze
   f. Packing: Asbestos free
   g. Handwheel: Malleable iron

B. Class 150, Bronze Globe Valves with Nonmetallic Disc

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Milwaukee Valve Company
   b. NIBCO Inc.
   c. Powell Valves
   d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description
   a. Standard: MSS SP-80, Type 2
   b. CWP Rating: 300 psig
   c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet
   d. Ends: Threaded
   e. Stem: Bronze
   f. Disc: PTFE or TFE
   g. Packing: Asbestos free
   h. Handwheel: Malleable iron

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install swing check valves for proper direction of flow and in horizontal position with hinge pin level.

F. Use unions at all final connections and where required to permit easy removal of valves, strainers, etc.

G. Provide ball valves and drain valves at the base of all new **hot water** pipe risers.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. **Shutoff Service:** Ball, butterfly, or gate valves.
2. **Throttling Service, Except Steam:** Globe or ball valves.
3. **Throttling Service, Steam:** Globe valves.
4. **Pump-Discharge Check Valves:**
   a. **NPS 2 and Smaller:** Bronze swing check valves with bronze or nonmetallic disc.
   b. **NPS 2-1/2 and Larger:** Iron swing check valves with lever and weight or with spring.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:
1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.5 WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, bronze with bronze trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.
4. Bronze Gate Valves: **Class 150**.
5. Bronze Globe Valves: **Class 150, nonmetallic** disc.

B. Pipe NPS 2-1/2 and Larger

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Swing Check Valves: **Class 250**, metal seats.
3. Iron Gate Valves: **Class 250**, OS&Y.
4. Iron Globe Valves, NPS 2-1/2 to NPS 12: **Class 250**.

END OF SECTION
SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Steel pipe hangers and supports
2. Trapeze pipe hangers
3. Metal framing systems
4. Thermal-hanger shield inserts
5. Fastener systems
6. Equipment supports

B. See Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

C. See Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-protection piping.

D. See Division 23 Section "Vibration Controls for HVAC Piping and Equipment" for vibration isolation devices.

E. See Division 23 Section(s) "Metal Ducts" and "Nonmetal Ducts" for duct hangers and supports.

1.2 DEFINITIONS

A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Pipe hangers and supports
2. Thermal-hanger shield inserts
3. Powder-actuated fastener systems
B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Equipment supports.

C. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers

1. B-Line Systems, Inc.; a division of Cooper Industries
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.
B. Manufacturers
   1. Carpenter & Paterson, Inc.
   2. ERICO/Michigan Hanger Co.
   3. Pipe Shields, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2" beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   1. Manufacturers
      a. Hilti, Inc.
      b. ITW Ramset/Red Head
      c. Powers Fasteners

B. Mechanical-Expansion Anchors: Insert-wedge-type [zinc-coated] [stainless] steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   1. Manufacturers
      a. B-Line Systems, Inc.; a division of Cooper Industries
      b. Hilti, Inc.
      c. ITW Ramset/Red Head
      d. Powers Fasteners

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.
2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

   2. Design Mix: 5000-psi, 28-day compressive strength.

2.8 PIPE ALIGNMENT GUIDES

A. Pipe alignment guides shall be manufactured by FMK and shall be Series FPA or approved equivalent.

B. Pipe guides shall be of carbon steel construction with painted finish.

C. Pipe guides shall be sized for either 1-1/2" thick or 2" thick insulation.

2.9 ANCHORS, GUIDES AND EXPANSION LOOPS

A. Anchors and guides shall be constructed of structural members, standard weight pipe and steel plates. Members shall be properly welded together with all corners mitered. Anchors and guides shall be bolted to structural members or joists. Anchors, guides and expansion loops shall be installed to provide for proper expansion of piping.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. **Yoke-Type Pipe Clamps (MSS Type 2):** For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4" of insulation.

3. **Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3):** For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4" of insulation.

4. **Adjustable, Steel Band Hangers (MSS Type 7):** For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.

5. **U-Bolts (MSS Type 24):** For support of heavy pipes, NPS 1/2 to NPS 30.

6. **Pipe Saddle Supports (MSS Type 36):** For support of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4" of insulation.

7. **Single Pipe Rolls (MSS Type 41) (adjustable roller hangers):** For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.

8. **Complete Pipe Rolls (MSS Type 44) (adjustable roller hangers):** For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

**G. Vertical-Piping Clamps:** Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. **Extension Pipe or Riser Clamps (MSS Type 8):** For support of pipe risers, NPS 3/4 to NPS 20.

2. **Carbon- or Alloy-Steel Riser Clamps (MSS Type 42):** For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

**H. Hanger-Rod Attachments:** Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. **Steel Turnbuckles (MSS Type 13):** For adjustment up to 6" for heavy loads.

2. **Steel Clevises (MSS Type 14):** For 120 to 450 deg F piping installations.

**I. Building Attachments:** Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. **Steel or Malleable Concrete Inserts (MSS Type 18):** For upper attachment to suspend pipe hangers from concrete ceiling.

2. **Top-Beam C-Clamps (MSS Type 19):** For use under roof installations with bar-joint construction to attach to top flange of structural shape.

3. **Side-Beam or Channel Clamps (MSS Type 20):** For attaching to bottom flange of beams, channels, or angles.

4. **Center-Beam Clamps (MSS Type 21):** For attaching to center of bottom flange of beams.

5. **Welded Beam Attachments (MSS Type 22):** For attaching to bottom of beams if loads are considerable and rod sizes are large.

6. **C-Clamps (MSS Type 23):** For structural shapes.

7. **Welded-Steel Brackets:** For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

   a. **Light (MSS Type 31):** 750 lb.
   b. **Medium (MSS Type 32):** 1500 lb.
   c. **Heavy (MSS Type 33):** 3000 lb.
8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4”.
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Perforated band iron, wire or chain will not be permitted for hangers or supports of pipe.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, concrete inserts, brackets, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation

1. Install powder-actuated fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

3. Submit sketches for proposed hangers indicating type of construction, number and size of piping and maximum spacing to engineer for approval.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.


H. Install hangers and supports to allow controlled thermal and movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and show maximum pipe deflections allowed by [ASME B31.1 (for power piping)] [and] ASME B31.9 (for building services piping) are not exceeded.

M. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.
   
   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   
   c. Do not exceed pipe stress limits according to [ASME B31.1 (for power piping)] [and] ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2: 12" long and 0.048" thick.
   b. NPS 4: 12" long and 0.06" thick.
   c. NPS 5 and NPS 6: 18" long and 0.06" thick.
   d. NPS 8 to NPS 14: 24" long and 0.075" thick.
   e. NPS 16 to NPS 24: 24" long and 0.105" thick.

5. Pipes NPS 8 and Larger: Include wood inserts.

6. Insert Material: Length at least as long as protective shield.

7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

N. Support horizontal piping as follows:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Max. Hanger Spacing</th>
<th>Hanger Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2&quot; to 1-1/4&quot;</td>
<td>6'-6&quot;</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>1-1/2&quot; to 2&quot;</td>
<td>10'-0&quot;</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>2-1/2&quot; to 3&quot;</td>
<td>10'-0&quot;</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>4&quot; to 6&quot;</td>
<td>10'-0&quot;</td>
<td>5/8&quot;</td>
</tr>
</tbody>
</table>

O. Install hangers to provide minimum 1/2" space between finished covering and adjacent work.

P. Place a hanger within 12" of each horizontal elbow.

Q. Use hangers with 1-1/2" minimum vertical adjustment.

R. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

S. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

T. Where exposed pipes pass through walls, floors or ceiling of finished rooms, furnish and install steel chromium-plated setscrew type floor, wall or ceiling plates.

U. Seal all openings through walls of air plenum spaces and relief air shafts, where ducts, pipelines, etc. are installed under this Contract to assure airtight plenum spaces. Coordinate all work with contractors of other trades.

V. Where pipes of any type pass through new fire barrier stops, ceilings, floors or walls, thoroughly seal such openings with fire-rated sealant as required to maintain fire-rating of adjacent construction.

W. All necessary structural supports and inserts to hang all piping and equipment shall be provided by this Contractor. Hanger rods shall be securely attached to plates. Where cutting is required for the installation of hangers, piping and supports, all openings must be neatly drilled by the HVAC Contractor. Punching or chipping of concrete will not be permitted. All necessary openings shall be drilled in a location and manner satisfactory to this Contractor.
to the Architect. All concrete damaged by the HVAC Contractor shall be patched, reinforced or replaced as directed by the Architect. Location of all holes, openings and sleeves shall clear reinforcing steel in floor and roof decks. Coordinate all work with the Architect and shall determine exact locations of all supports and openings, especially vibration isolation.

X. Furnish and install all structural steel members for the support of the piping, ductwork and equipment to suit the structural and vibration isolation conditions. Place all hanger and support inserts in concrete. Special studs "shot" into concrete will not be permitted.

Y. Strap hangers, wire hangers, or split-ring hangers will not be acceptable. Clevis hangers are acceptable only as hereinbefore specified for copper tubing.

Z. Insulation shall be installed over band hangers and all openings shall be sealed as hereinafter specified.

AA. Hanger rods installed in conjunction with hangers shall be not less than 3/8" for pipe sizes 1/2" to 2"; 1/2" for pipe sizes 2-1/2" and 3"; 5/8" for pipe sizes 4" and 5"; 3/4" for 6" pipe; and 7/8" for 8" to 12" pipe sizes. Hanger rods shall be larger where recommended by the hanger manufacturer.

BB. Lines 2" and smaller supported on steel joists shall be hung from one joist with beam clamps. Lines over 2" and 3" in diameter shall be suspended from 1-1/4" steel pipe or steel angel, laid-in and hook-bolted to the web members of the joists. Lines 4" and 5" shall be supported from three joists. Lines 6" and over shall be supported from not less than four joists.

CC. Lines along walls shall be supported on neat, substantial wall hangers, securely attached to construction by means of inserts or expansion sleeves and bolts. Wall hangers shall be similar to Modern Hanger Corporation Fig. 285, Penn Pipe Hanger Co., Arrow Pipe Hanger Co., or approved equal.

DD. All supports directly in contact with copper lines shall be all copper where possible or copper-plated where approved by the Architect. Ferrous metals shall not be used in contact with copper lines. Hangers shall be all-copper as hereinbefore specified.

EE. Where vertical pipes pass through floors in mechanical equipment areas, chases or pipe spaces, construct watertight sleeves made up of a section of Schedule 40 steel pipe extending 2" above the floor.

FF. Where vertical pipes pass through floors in finished spaces, construct watertight sleeves made up of a section of steel pipe of proper length to extend through masonry and terminate flush on finish side.

GG. Where horizontal pipes pass through walls, sleeves shall be as specified above terminating flush with finish on each side.

HH. Where vertical pipes pass through plaster or dry wall ceilings, sleeves shall be No. 18 gauge galvanized steel flush with ceiling.
II. Where piping is insulated, insulation shall be extended through sleeves. Sleeves shall be at least two sizes larger than the pipe or of suitable dimensions to allow the installation of pipe, insulation and sealant.

JJ. At all locations, space between sleeve and pipe shall be filled with sealant to level of sleeve. Sealant shall be Dow Corning 3-6548RTV, or approved equal. Conform with manufacturer’s recommended installation procedures.

KK. All pipe runs 3" or larger connected to mechanical equipment shall be mounted with steel spring isolators. The first three pipe hangers in the main lines near the mechanical equipment shall be Mason Industries type PC3ON (or equal). Horizontal runs in all other locations shall be isolated by Mason Industries type 30N (or equal) hangers. Floor supported piping shall rest on restrained mounts, Mason Industries type SLR (or equal). The first three hangers or mounts near the mechanical equipment shall have the same static deflection as specified for the mountings under the connected equipment. All other hangers and mounts shall have a minimum static deflection of 3/4".

LL. For vertical pipe runs, risers shall be suspended from or supported by steel spring isolators (Mason Industries type PC3ON hangers, type SLR mounts, or equal) and the piping anchored or guided by all-directional anchors (Mason Industries type ADA, or equal). Steel spring deflections shall be 3/4", except in those expansion locations where additional deflection is required to limit deflection or load changes to ± 25% of the initial stress.

3.3 SLEEVES

A. Provide sleeves where piping and raceways pass through masonry construction. Extend each sleeve through its respective floor, wall or partitions and cut flush with each surface unless otherwise indicated for installation of new piping. Pipe sleeves will not be required at core drilled holes. Fill space between pipe and wall of opening with UL approved silicone RTV Foam Sealant "Dow Corning" 3-6548, or equivalent.

B. In floors use sleeves of standard weight steel pipe finished with smooth edges. For other than masonry partitions, through suspended ceilings and plaster surfaces; use 20 gauge galvanized iron sleeves. Fill space between pipes and sleeves with UL approved silicone RTV Foam Sealant "Dow Corning" 3-6548, or equivalent.

C. Properly install and cement sleeves in place.

D. Extend floor sleeves 1" above finished floor in wet areas and in areas having floor drains. Caulk space between floor and sleeves and piping or raceways with UL approved silicone RTV Foam Sealant "Dow Corning" 3-6548 and waterproofing compound as approved.

E. Where piping or raceways pass through waterproofed floors and walls; design sleeves so that waterproofing can be flashed into and around the sleeves.

F. Provide chromium plated steel, hinge type floor and ceiling plates with spring retainers on piping passing through walls, floors and ceilings in finished areas.

G. Fit sleeves through exterior walls below grade with seals equal to Thunderline "Link Seal" or OZ type FSK.
3.4 FABRICATION

A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

B. Design hangers without disengagement of supported pipe.

C. Provide copper plated hangers and supports for copper piping.

3.5 FASTENINGS

A. For fastenings and attachments such as screws, bolts, nuts, etc.: use non-ferrous silicon bronze, or galvanized or cadmium plated steel. Where such devices are not commercially available in non-ferrous metals, or in steel with a protective coating: use fastenings and attachments made of such materials or so protected to offer maximum protection against deterioration from age, weather and dampness. Where subject to weather or wet locations use stainless steel bolts and screws.

B. Do not support items by nylon ties, tape or tie wire, or perforated metal straps. Where items are to be fastened to masonry construction: do not use wooden or fiber plugs. Use screws or bolts in conjunction with approved lead-alloy expansion sleeves (Hilti or equivalent). As desired use approved plastic anchors for #10 and smaller screws, up to static loads of 20 lbs. per screw. Insert anchors fully in solid masonry (not in plaster, etc.).

3.6 FINISH

A. Prime coat exposed steel hangers and supports. Hangers and supports located in pipe shafts, and suspended ceiling spaces are not considered exposed.

3.7 MISCELLANEOUS IRON WORK

A. Furnish and install all miscellaneous iron work including, but not limited to, piping hangers, piping anchors and guides, ductwork supports, and all other equipment supports. All additional structural members shall be furnished and installed to support the heating, ventilating and air conditioning equipment without excessive stress or strain on the building construction. Structural beams and other structural members shall be furnished and installed under this Contract for anchors and guides where the building steel is not available or capable of supporting or anchoring pipe lines and equipment.

B. All equipment and materials furnished and installed under this Contract which are not mounted on bases or floors shall be securely attached and supported from the main supporting structure of the building by metal hangers, clamps and/or brackets. Metal hangers, clamps and/or brackets shall be of suitable design and of sufficient strength to properly and safely support the materials and equipment involved. Lag screws and bolts shall be used where required at wood construction.

C. Materials
1. Structural steel members for the support of equipment installed under this Contract shall conform to ASTM Specifications A-36 and shall comply with the latest requirements of the American Institute of Steel Construction. Structural steel shall be of standard sections as given in the structural steel manufacturers' handbooks.

D. Priming

1. All steel and iron work shall be primed with Rust-Oleum X-60, or equivalent. Before priming all metal shall be thoroughly cleaned free from scale, rust, and dirt.

E. Anchors

1. Provide all anchors, bolts, screws, dowels, and connecting members and do all cutting and fitting necessary to secure the work to adjoining construction. Build in connecting members to masonry, concrete, and structural steel as the new and remodeling work progresses.

F. Supports and Brackets

1. Supports and brackets shall be neatly constructed of structural shapes to adequately support the equipment intended. All supports must be approved prior to installation. Field conditions will regulate the type of support.

3.8 EQUIPMENT BASES, SUPPORTS, AND LINTELS

A. Unless otherwise indicated, provide construction of concrete equipment foundations required for equipment furnished under this section.

B. Provide miscellaneous structural steel, pipe, grating, steel plate, hangers, etc., required for stands or platforms to support equipment furnished under Contract.

C. Provide steel lintels for openings in masonry walls required for items installed under Contract. Coordinate installation of lintels with other contractors, unless otherwise noted.

D. Length of bearings at each end of lintels: not less than 1" per foot of span and in no case less than 6"; 3-1/2" x 3-1/2" x 3/8" steel angles for all walls 8" or over. One angle for every 4" of wall thickness. Steel shall conform to ASTM A7 or A36. Paint lintels with two shop coats of red Rustoleum. Lampblack shall meet Federal Specification TT-P-350a.

E. Concrete used in construction of envelopes, encasements, and duct structures: 28 day, 3000 psi compressive strength proportions. No concrete tests are required unless otherwise indicated. Use normal Portland cement, Type I or Type II, conforming to ASTM C150. Conform to ACI 613, 614 and 318, latest edition for concrete work.

F. Reinforcement bars: conform to ASTM Standards and provide in quantity and of sizes shown on drawings or specified herein.
3.9 STRUCTURAL STEEL

A. Provide all labor, materials, services and equipment for furnishing and erection of structural steel for pipe anchors, pipe support stands, catwalks, and ladders, complete as specified herein, shown on drawings, or required.

B. All structural steel shall have a minimum yield strength of 36,000 PSI. All welds shall be full strength E70XX electrodes.

C. Structural steel shall be new, standard sections of minimum weights shown and shall conform to ASTM Tentative Specifications for Steel Bridges and Buildings, Serial Designation A36.


E. Bolts other than high-strength bolts shall be unfinished bolts with regular semi-finished heads and square heavy series nut, complying with ASTM A307-55T, Grade A and ASA D18.2-1952.

F. Materials shall be quality equal to that called for by applicable ASTM Specifications for classifications covering its intended use. Mill test reports shall constitute a record as to quality of material.

G. Shop Drawings

1. Prepare and furnish shop drawings for approval as required by contract. No fabrication shall be started until shop drawings have been returned to fabricator with Architect's final approval stamp affixed, without qualifications.

2. Check all shop drawings submitted by his fabricator or subcontractor for errors before forwarding drawings to the Architect for review. After shop drawings have been checked and corrections noted thereon by Contractor, he shall affix his form stamp and initial each print before forwarding to Architect.

3. Contractor's failure to check shop drawings prior to forwarding to Architect will result in delay in obtaining final approval.

4. Approval of shop drawings by Architect will be general and will not relieve Contractor of responsibility for proper fitting and construction of work, nor from furnishing material required, even though not shown on approved shop drawings.

5. Shop drawings shall include anchor bolt layout, erection diagram and detailed drawings for all structural steel furnished.

6. Shop drawings shall give complete information necessary for fabrication of component parts of structure, including location, type, size and extent of all welds. Drawings shall clearly distinguish between bolts and welds.

7. Shop drawings shall be made in conformity with best modern practices, with due regard to speed and economy in fabrication and erection.

8. Where layout or dimensions locating steel depend on work of other trades, ask for required information before detail drawings are started. Failure to do so will cause you to be responsible for any misfit.
9. After shop drawings have been approved, 7 sets of prints of final shop drawings shall be furnished to Architect. In addition, furnish prints for erection purposes and for work of other Contractors whose work is related to the structural steel.

H. Design

1. Except for those items peculiar to this installation, or as otherwise shown or noted, steel shall be designed, fabricated and erected in accordance with Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, as amended to date, and Code of Standard Practice for Steel Buildings and Bridges, latest edition, both as adopted by American Institute of Steel Construction.

2. Design of connections shall be in accordance with specifications for foregoing AISC reference. Field connections of all bases shall be made with high-strength bolts as specified. All shop connections shall be riveted or welded. Use bearing type connections. No connection shall be less than Type "B" Series.

3. No combination of rivets and bolts, either high-strength or unfinished shall be used in same face of any connection.

4. Care shall be exercised to add additional reinforcing as required where members are cut or coped to meet framing conditions.

I. Welded Construction

1. All welding shall be done by electric arc, in accordance with latest Welding Society Code and Fabrication Section of AISC Specifications referenced herein.

2. Welds shall be made only by operators who have been previously qualified by tests as prescribed in Standard Qualifications Procedure of American Welding Society, to perform type of work required, except that this provision need not apply to tack welds not later incorporated into finished welds carrying calculated stress.

J. Bolts - Semi-finished high-strength bolts shall be used for erection of structural sections at locations where oversized below or slots are provided for movement.

K. Fabrication

1. All workmanship shall be equal to best practices in modern structural shops.

2. All material shall be clean and straight. If straightening or flattening is necessary, it shall be done by a process and in a manner that will not injure the material. Sharp kinks or bends shall be cause for rejection.

3. Surfaces to be welded shall be free from loose scale, slag, rust, grease, paint and any other foreign material, except that mill scale which withstands vigorous wire brushing may remain. A light film of linseed oil may be disregarded. Joint surfaces shall be free from fins and tears. Preparation of edges by gas cutting shall, wherever practicable, be done with a mechanically guided torch.

4. Parts to be fillet welded shall be brought in as close contact as practicable and in no event shall be separated more than 3/16". If the separation is 1/16" or greater, the size of fillet weld shall be increased by amount of separation. Separation between faying surfaces of lap joints shall not exceed 1/16". Fit of joints at contact surfaces which are not completely sealed by welds shall be close enough to exclude water after painting.
5. Abutting parts to be butt welded shall be carefully aligned. Misalignments greater than 1/8" shall be corrected and in making the corrections the part shall not be drawn into a sharper slope than 2° (1/16" in 12").
6. Work shall be positioned for flat welding whenever practicable.
7. No welding shall be done when temperature of base metal is lower than 0°F. At temperatures between 32°F and 0°F, the surface of all areas within 3" of point where weld is to be started shall be heated to a temperature at least warm to the hand before welding is started.
8. Holes for high strength bolts shall be punched or drilled truly cylindrical and not more than 1/16" larger than external diameter of bolt.
9. Surfaces or parts adjacent to bolt head and nut shall be parallel fit solidly when assembled, without gaskets or fillers of flexible material. Faying surfaces may be painted. If left unpainted, faying surfaces shall be descaled or carrying normal mill scale and free of lacquer, dirt, grease, oil, loose scale, burrs, or pits.

L. Erection

1. Furnish all equipment required for erection of structural steel and provide for its operation. Assume all risks from storms or accidents and all damage to persons and property resulting from his work until his work is completed.
2. All framing shall be carried up plumb, and temporary bracing shall be introduced wherever necessary to take care of all loads to which structure may be subjected including piles of materials and equipment and operation of same. Such bracing shall be left in place as long as may be required for safety.
3. As erection progresses, work shall be securely bolted up to take care of dead load, wind and erection stresses.
4. No bolting shall be done until as much of the structure as will be stiffened by bolting has been aligned properly.

M. Painting

1. Before leaving the shop all steel work shall be thoroughly cleaned by effective means, of all loose mill scale, rust and foreign matter. One shop coat of Pratt & Lambert Noxide red lead primer or equivalent paint as manufactured by Sterling Varnish Co., (Nocoro) or #99 red metal primer as manufactured by Tnemec Co., shall be applied to all steel work at fabricating shop.
2. Paint shall be applied to dry surfaces, evenly and thoroughly, and well worked into joints. Contact surfaces shall be adequately cleaned before assembly, but not painted.
3. All bare spots, bolts, welded areas and areas where shop coat has been abraded or removed shall be spot-primed with material used for shop coat after erection and after steel has been cleaned. Spot-priming shall be approved before field coat is applied.
4. Field coat all structural steel handrails, ladders, etc., with two coats of Rustoleum in color selected by Architect.

3.10 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION
SECTION 230533 - HEAT TRACING FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes heat tracing with the following electric heating cables:
   2. Self-regulating, parallel resistance.

B. See Division 21 Section "Heat Tracing for Fire-Suppression Piping."

C. See Division 22 Section "Heat Tracing for Plumbing Piping."

1.2 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.
   1. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.

B. Shop Drawings: For electric heating cable. Include plans, sections, details, and attachments to other work.

C. Field quality-control test reports.

D. Operation and maintenance data.

E. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Raychem; a division of Tyco Thermal Controls.
2. BH Thermal Corporation.
3. Chromalox, Inc.; Wiegard Industrial Division; Emerson Electric Company.
4. Easy Heat Inc.

C. Heating Element: Pair of parallel stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled nonheating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.

D. Electrical Insulating Jacket: Flame-retardant polyolefin.

E. Cable Cover: polyolefin outer jacket with UV inhibitor.

F. Maximum Operating Temperature (Power On): 150°F.

G. Maximum Exposure Temperature (Power Off): 185°F.

H. Maximum Operating Temperature: 300°F.

I. Capacities and Characteristics:


2.2 CONTROLS

A. Remote bulb unit with adjustable temperature range from 30 to 50°F.

B. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.
C. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.

D. Corrosion-resistant, waterproof control enclosure.

2.3 ACCESSORIES

A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

B. Warning Labels: Refer to Division 23 Section "Identification for HVAC Piping and Equipment."

C. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, Less than 6": 3/4" minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6" or Larger: 1-1/2" minimum.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install electric heating cable across expansion joints according to manufacturer's written recommendations using slack cable to allow movement without damage to cable.

B. Install electric heating cables after piping has been tested and before insulation is installed.

C. Install electric heating cables according to IEEE 515.1.

D. Install insulation over piping with electric cables according to Division 23 Section "HVAC Insulation."

E. Install warning tape on piping insulation where piping is equipped with electric heating cables.

F. Set field-adjustable switches and circuit-breaker trip ranges.

G. Protect installed heating cables, including nonheating leads, from damage.

H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
3.2 FIELD QUALITY CONTROL

A. Testing: Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.

1. Test cables for electrical continuity and insulation integrity before energizing.
2. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.

B. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounting cables.

C. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Equipment labels
2. Valve tags
3. Pipe labels
4. Duct labels

1.2 SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Seton
B. Brimar
C. Bunting
D. Brady Co.
E. Kimball Systems

2.2 MATERIALS


B. Laminated Plastic Nameplates: 3" x 1" Laminated three-layer plastic with engraved black (1/4" high) letters on white background. Engraved micarta with pressure-sensitive backing and shall be nonabsorbent, non-porous and colorfast.

C. Plastic Tags: Laminated three-layer plastic with engraved black (1/4" high) letters on white background. Tag size minimum 1" x 2" square.
D. Stencils: With clean cut symbols and letters of following size:

<table>
<thead>
<tr>
<th>Outside Diameter of Insulation or Pipe</th>
<th>Length of Color Field</th>
<th>Size of Letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4&quot; - 1-1/4&quot;</td>
<td>8&quot;</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>1-1/2&quot; - 2&quot;</td>
<td>8&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>2-1/2&quot; - 6&quot;</td>
<td>12&quot;</td>
<td>1-1/4&quot;</td>
</tr>
<tr>
<td>8&quot; - 10&quot;</td>
<td>24&quot;</td>
<td>2-1/2&quot;</td>
</tr>
<tr>
<td>Over 10&quot;</td>
<td>32&quot;</td>
<td>3-1/2&quot;</td>
</tr>
</tbody>
</table>

E. Stencil Paint: In accordance with Division 09, semi-gloss enamel.

F. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and fluid being conveyed.

G. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape of not less than 6" wide by 4 mil thick, manufactured for direct burial service.

H. Do not use stick on labels.

2.3 VALVE TAGS

A. Tag each new valve, controller, and other devices requiring adjustment and affecting the performance of equipment furnished under this Contract. Prepare a list giving the number of each valve, its location, and the equipment or portion of the system tagged. The list shall be enclosed in a metal frame with glass and shall be hung where directed. Tags shall be of aluminum or brass, 2" in diameter with numbers as large as possible and attached by short, small link aluminum or brass chains or "S" hooks. Numbers and tags shall be coordinated with those being installed under this Contract.

B. Prepare a typewritten list giving the number of each valve, its location, and the equipment or portions of the system controlled. The list shall be enclosed in a metal frame with glass. The list shall be hung at location directed by Architect.

C. Contractor shall match existing identification nomenclature presently in use at facility.

2.4 EQUIPMENT IDENTIFICATION

A. Where valves, cleanouts, dampers, etc., are located above removable tile ceiling or above access panels, furnish and install identification labels on the corners of the access panels or removable ceiling tiles. Labels shall be provided with the word "VALVES", "RELAY", "DAMPER", etc., so that the equipment may be readily located in the future.

B. Adhesive backing shall be chemically compounded to hold tight and fast at wide temperature extremes. Labels shall be additionally secured with screws or rivets. Flexible plastic punched tapes will not be acceptable. Labels shall be coordinated with those being installed under other contracts.
C. All major pieces of HVAC equipment shall include, at a suitable and accessible observation point on the equipment, a manufacturer's stamped brass or aluminum identification plate, with all pertinent capacity data stamped on the plate. Identification plate shall include all specific data, such as model number, serial number, motor data, horsepower, capacities, sizes, amperes, power consumption, speed, flows in GPM, temperatures, working pressures, operating pressures, and similar factors as applicable. In addition, pumps shall include total head in feet and impeller sizes.

D. The Contractor shall be responsible for furnishing and attaching an identification plate for the above mentioned major equipment if not provided by the equipment manufacturer.

E. Equipment marking tags shall be engraved phenolic, 1/16" thick, four edges bound, black with white lettering. The tag shall be securely mounted to the equipment with minimum of two (2) – 3/8" long No. 3 screws. Tags shall provide such information as: "Exhaust Fan – EF2," "Air Handling Unit – AHU 1" and include "date of installation and project number".

F. All remote starters and disconnects shall also be tagged with the equipment they serve. (i.e. "AHU-1", EF-1", etc.)

G. The installations will not be considered acceptable unless identification plates and nameplates are attached.

2.5 PIPING IDENTIFICATION

A. All piping insulated and uninsulated, installed throughout this Contract, shall be stenciled with the name of the service, such as HWS, CWS, etc., and with an arrow indicating the direction of flow.

B. Stenciled letters shall in general, be plain black and shall be located near each branch connection, at each valve, at each change in direction, on each side of walls or floors, and at least every 20' on straight runs of pipe. On smaller runs of piping, center the designations. In lieu of stenciling, snap-around pipe markers by Seton Nameplate Co. "Set Mark", or approved equivalent may be utilized. Identification and colors shall comply with ANSI A13.1. Snap-around markers shall be suitable for exterior use where utilized.

C. Where pipes are adjacent to each other, markings shall be neatly lined up. All markings shall be located in such a manner as to be easily legible from the floor. Markings on black pipes shall be white.

2.6 DUCT IDENTIFICATION

A. All ductwork insulated and uninsulated, installed throughout this Contract, shall be stenciled with the name of the service, such as supply, exhaust, etc., and with an arrow indicating the direction of flow.

B. Stenciled letters shall in general, be plain black and shall be located near each branch connection, at each change in direction, on each side of walls or floors, and at least every 20' on straight runs of duct.
C. Where ducts are adjacent to each other, markings shall be neatly lined up. All markings shall be located in such a manner as to be easily legible from the floor.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare surfaces in accordance with Division 09 for stencil painting.

3.2 INSTALLATION

A. Plastic Nameplates: Install with corrosion-resistant mechanical fasteners, adhesive not acceptable.

B. Plastic Tags: Install with corrosion-resistant chain.

C. Stencil Painting: Apply in accordance with Division 09.

D. Plastic Pipe Markers: Install in accordance with manufacturer's instructions.

E. Underground Plastic Pipe Markers: Install 6" to 8" below finished grade, directly above buried pipe.

F. Controls: Identify control panels and major control components outside panels with plastic nameplates. Secured with screws. Do not use adhesive.

G. Valves: Tag each valve in main and branch piping, but no individual shutoff or local control valves at equipment.

H. Piping: Identify piping, concealed or exposed, with plastic pipe markers or stenciled painting. Tags may be used on small diameter piping. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and "T", at each side of penetration of structure or enclosure, and at each obstruction.

3.3 VALVE CHART AND SCHEDULE

A. Provide valve chart and schedule in aluminum frame with clear plastic shield. Install at location as directed.

B. Provide whiteprint schedules framed under glass, showing number, location, color code and designation of piping controlled, mounted in a designated location. Provide two additional copies of valve schedule in hardback covers to Owner.

C. Contractor shall match existing piping and equipment identification nomenclature presently in use at facility. If facility does not have a standard system use the table below.
D. Mark pipes and tag valves in accordance with the following table.

<table>
<thead>
<tr>
<th>Service</th>
<th>Marking</th>
<th>Tag</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold Water</td>
<td>Cold Water</td>
<td>C.W.</td>
</tr>
<tr>
<td>Gas</td>
<td>Gas</td>
<td>G.</td>
</tr>
<tr>
<td>High Pressure Steam</td>
<td>H.P. Steam -100#</td>
<td>H.P.S.-100</td>
</tr>
<tr>
<td>Medium Pressure Steam</td>
<td>M.P. Steam - 40#</td>
<td>M.P.S.-40</td>
</tr>
<tr>
<td>Low Pressure Steam</td>
<td>L.P. Steam - 15#</td>
<td>L.P.S.-15</td>
</tr>
<tr>
<td>Drain</td>
<td>Drain</td>
<td>---</td>
</tr>
<tr>
<td>Condensate Return</td>
<td>Condensate Return</td>
<td>COND.R</td>
</tr>
<tr>
<td>LP-Gas</td>
<td>LP-Gas</td>
<td>L.P.G.</td>
</tr>
<tr>
<td>Boiler Feedwater</td>
<td>Boiler Feedwater</td>
<td>B.F.W.</td>
</tr>
<tr>
<td>Fuel Oil Supply</td>
<td>Fuel Oil Supply</td>
<td>F.O.S.</td>
</tr>
<tr>
<td>Fuel Oil Return</td>
<td>Fuel Oil Return</td>
<td>F.O.R.</td>
</tr>
<tr>
<td>Blowdown Lines</td>
<td>Blowdown</td>
<td>B.D.</td>
</tr>
<tr>
<td>Chemical</td>
<td>Chemical</td>
<td>CHEM.</td>
</tr>
<tr>
<td>Soft Water</td>
<td>Soft Water</td>
<td>S.W.</td>
</tr>
<tr>
<td>Vent</td>
<td>Vent</td>
<td>---</td>
</tr>
<tr>
<td>Compressed Air</td>
<td>Air 50#</td>
<td>A-50</td>
</tr>
<tr>
<td>Chilled Water Supply</td>
<td>Chilled Water Supply</td>
<td>CH.W.S.</td>
</tr>
<tr>
<td>Chilled Water Return</td>
<td>Chilled Water Return</td>
<td>CH.W.R</td>
</tr>
<tr>
<td>Condenser Water Supply</td>
<td>Condenser Water Supply</td>
<td>C.S.</td>
</tr>
<tr>
<td>Condenser Water Return</td>
<td>Condenser Water Return</td>
<td>C.R.</td>
</tr>
<tr>
<td>Hot Water Supply</td>
<td>Hot Water Supply</td>
<td>H.W.S.</td>
</tr>
<tr>
<td>Hot Water Return</td>
<td>Hot Water Return</td>
<td>H.W.R.</td>
</tr>
<tr>
<td>Refrigeration Suction</td>
<td>Refrigeration Suction</td>
<td>R.S.</td>
</tr>
<tr>
<td>Refrigeration Liquid</td>
<td>Refrigeration Liquid</td>
<td>R.L.</td>
</tr>
<tr>
<td>Reheat Water Supply</td>
<td>Reheat Water Supply</td>
<td>RHWS</td>
</tr>
<tr>
<td>Reheat Water Return</td>
<td>Reheat Water Return</td>
<td>RHWR</td>
</tr>
<tr>
<td>Heat Transfer Water Supply</td>
<td>Heat Transfer Supply</td>
<td>HTS</td>
</tr>
<tr>
<td>Heat Transfer Water Return</td>
<td>Heat Transfer Return</td>
<td>HTR</td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Balancing Air Systems
   a. Constant-volume air systems

2. Balancing Hydronic Piping Systems
   a. Constant-flow hydronic systems
   b. Variable-flow hydronic systems

1.2 DEFINITIONS

C. TAB: Testing, adjusting, and balancing.
D. TABB: Testing, Adjusting, and Balancing Bureau.
E. TAB Specialist: An entity engaged to perform TAB Work.

1.3 REFERENCES

A. AABC - National Standards for Field Measurement and Instrumentation, Total System Balance.
C. NEBB – Procedural Standards for testing, Balancing and Adjusting of Environmental Systems.

1.4 SUBMITTALS

A. LEED Submittal
   1. Air balance report for LEED Prerequisite EQ-1: Documentation of work performed for ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing".

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.
3. All field work by the Testing, Adjusting, and Balancing Firm shall be under the direct supervision of a registered Professional Engineer, licensed to practice in the Commonwealth of Pennsylvania and who is a full time employee of the firm.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.


D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, “Instrumentation.”

1.6 TESTING AND BALANCE REPORT

A. Provide the services of an independent qualified testing, adjusting and balancing firm as approved by the Owner’s Representative. The testing, adjusting and balancing firm shall submit evidence that it has been engaged in this type of service for a minimum of five (5) years and that it has balanced systems of comparable size and complexity as specified for the project.

B. HVAC Contractor and balancing firm are responsible for testing, adjusting and balancing air and water systems and balancing and adjusting existing equipment and systems where this equipment and systems are being altered under this Contract.

C. Coordinate the balancing work with all other Contractors, Temperature Control Subcontractor, Owner’s Representative and the Owner. Temperature Control Subcontractor shall adjust controls. Perform balancing of the heating systems when outdoor air temperature is averaging below 30°F and the cooling systems when outdoor air temperature is above 80°F.

D. Contractor shall furnish and install new sheaves, if required, to balance the air systems, at no additional cost.
PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Metal Ducts and Nonmetal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation. Verify that dirty filters have been removed and that new clean filters are in place.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.


B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."
C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure Total Airflow

   a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:
a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet or through the flexible connection.
c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
   a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.

5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.

7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.
   a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.

3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check liquid level in expansion tank.
3. Check makeup water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.7 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.

a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Architect and comply with requirements in Division 23 Section "Hydronic Pumps."
2. Check system resistance. With all valves open, read pressure differential across
the pump and mark pump manufacturer's head-capacity curve. Adjust pump
discharge valve until indicated water flow is achieved.

   a. Monitor motor performance during procedures and do not operate motors
      in overload conditions.

3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower
for the system based on pump manufacturer's performance data. Compare
calculated brake horsepower with nameplate data on the pump motor. Report
conditions where actual amperage exceeds motor nameplate amperage.

4. Report flow rates that are not within plus or minus 10 percent of design.

B. Measure flow at all automatic flow control valves to verify that valves are functioning as
designed.

C. Measure flow at all pressure-independent characterized control valves, with valves in
fully open position, to verify that valves are functioning as designed.

D. Set calibrated balancing valves, if installed, at calculated presettings.

E. Measure flow at all stations and adjust, where necessary, to obtain first balance.

   1. System components that have Cv rating or an accurately cataloged flow-pressure-
drop relationship may be used as a flow-indicating device.

F. Measure flow at main balancing station and set main balancing device to achieve flow
that is 5 percent greater than indicated flow.

G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

   1. Determine the balancing station with the highest percentage over indicated flow.
   2. Adjust each station in turn, beginning with the station with the highest percentage
      over indicated flow and proceeding to the station with the lowest percentage over
      indicated flow.
   3. Record settings and mark balancing devices.

H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm,
pump heads, and systems' pressures and temperatures including outdoor-air temperature.

I. Measure the differential-pressure-control-valve settings existing at the conclusion of
balancing.

J. Check settings and operation of each safety valve. Record settings.

3.8 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following
data:

   1. Manufacturer's name, model number, and serial number.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.9 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.10 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:
   1. Entering- and leaving-water temperature.
   2. Water flow rate.
   3. Water pressure drop.
   4. Dry-bulb temperature of entering and leaving air.
   5. Wet-bulb temperature of entering and leaving air for cooling coils.
   6. Airflow.
   7. Air pressure drop.

B. Measure, adjust, and record the following data for each refrigerant coil:
   1. Dry-bulb temperature of entering and leaving air.
   2. Wet-bulb temperature of entering and leaving air.
   3. Airflow.
   4. Air pressure drop.
   5. Refrigerant suction pressure and temperature.

3.11 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
   1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
   2. Air Outlets and Inlets: Plus or minus 10 percent.
   3. Heating-Water Flow Rate: Plus or minus 10 percent.
   4. Cooling-Water Flow Rate: Plus or minus 10 percent.
3.12 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.13 FINAL REPORT

A. General: Prepare and submit four (4) copies of a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

a. Indicated versus final performance.
b. Notable characteristics of systems.
c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:
   a. Settings for outdoor-, return-, and exhaust-air dampers.
   b. Conditions of filters.
   c. Cooling coil, wet- and dry-bulb conditions.
   d. Face and bypass damper settings at coils.
   e. Fan drive settings including settings and percentage of maximum pitch diameter.
   f. Inlet vane settings for variable-air-volume systems.
   g. Settings for supply-air, static-pressure controller.
   h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.

3.14 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION
SECTION 23 07 00 - HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Insulation Materials
   a. Cellular glass
   b. Flexible elastomeric
   c. Mineral fiber
   d. Calcium silicate

2. Fire-rated insulation systems
3. Insulating cements
4. Adhesives
5. Mastics
6. Sealants
7. Factory-applied jackets
8. Field-applied fabric-reinforcing mesh
9. Field-applied jackets
10. Tapes
11. Securements
12. Corner angles

B. Related Sections

1. Division 21 Section "Fire-Suppression Systems Insulation."
2. Division 22 Section "Plumbing Insulation."
3. Division 23 Section "Metal Ducts" for duct liners.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-respose characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Cell-U-Foam Corporation; Ultra-CUF.
   b. Pittsburgh Corning Corporation; Foamglas Super K.

2. Block Insulation: ASTM C 552, Type I.

3. Special-Shaped Insulation: ASTM C 552, Type III.

4. Board Insulation: ASTM C 552, Type IV.

5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.


7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Aeroflex USA Inc.; Aerocel.
   b. Armacell LLC; AP Armaflex.
   c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. CertainTeed Corp.; Duct Wrap.
   b. Johns Manville; Microlite.
   c. Knauf Insulation; Duct Wrap.
   d. Manson Insulation Inc.; Alley Wrap.
   e. Owens Corning; All-Service Duct Wrap.

I. High-Temperature, Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type V, without factory-applied jacket.

1. Products: Subject to compliance with requirements, provide one of the following:
   b. Owens Corning; High Temperature Flexible Batt Insulations.

J. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ. For equipment applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. CertainTeed Corp.; Commercial Board.
   b. Fibrex Insulations Inc.; FBX.
   c. Johns Manville; 800 Series Spin-Glas.
   d. Knauf Insulation; Insulation Board.
   e. Manson Insulation Inc.; AK Board.
   f. Owens Corning; Fiberglas 700 Series.

K. High-Temperature, Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type III, without factory-applied jacket.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Fibrex Insulations Inc.; FBX.
   b. Johns Manville; 1000 Series Spin-Glas.
   c. Owens Corning; High Temperature Industrial Board Insulations.
   d. Rock Wool Manufacturing Company; Delta Board.
   e. Roxul Inc.; Roxul RW.
f. Thermafiber; Thermafiber Industrial Felt.

L. Mineral-Fiber, Preformed Pipe Insulation

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Fibrex Insulations Inc.; Coreplus 1200.
   b. Johns Manville; Micro-Lok.
   c. Knauf Insulation; 1000 Pipe Insulation.
   d. Manson Insulation Inc.; Alley-K.
   e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

3. Type II, 1200 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

M. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Knauf Insulation; Permawick Pipe Insulation.
   b. Owens Corning; VaporWick Pipe Insulation.

N. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. CertainTeed Corp.; CrimpWrap.
   b. Johns Manville; MicroFlex.
   c. Knauf Insulation; Pipe and Tank Insulation.
   d. Manson Insulation Inc.; AK Flex.
   e. Owens Corning; Fiberglas Pipe and Tank Insulation.

O. Duct Liner
1. Products: Subject to compliance with requirements, provide one of the following:
   a. K-Flex Gray Duct Liner.
   b. AeroFlex USA Inc.; Aerocel.
   c. Armacell LLC; AP Armaflex.

2. Density: 1.5 PCF, 2.0 PCF, 3.0 PCF.

3. Maximum thermal conductivity of 0.25 BTU-In/Hr-FT\(^2\) - °F@75°F mean temperature.

4. Minimum R value of 4.2 at nominal 1" thickness.

5. Maximum water vapor transmission rate of 0.06 perm in.

6. Minimum sound absorption coefficient (NRC) of 0.5 at nominal 1" thickness.

7. Greenguard listed as mold resistant for resistance to mold growth.

8. Greenguard certified, meeting the "Children and Schools" classification requirements for VOC and formaldehyde content.

9. Flame spread rating not greater than 25 and smoke developed rating not greater than 50 when tested in accordance with ASTM E84 at 1" thickness.

P. Hydrous Calcium Silicate: Rigid molded insulation; asbestos-free coded throughout the material thickness and maintained throughout the temperature range.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Industrial Insulation Group, LLC (Cal Silite/Johns Manville Joint Venture).

2. Thermal Conductivity (K value) of 0.40 at 300 degrees F. Mean temperature.

3. Maximum Service temperature 1200 degrees F.

4. Compressive strength (block) minimum 160 psi to produce 5% compression at 1-1/2" thickness.

5. Tie wire 16 gauge stainless steel with twisted ends on maximum 12" centers.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

2.4 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. PVDC Jacket for Outdoor Applications: 6-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

2.5 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/square inch, in a Leno weave, for duct, equipment, and pipe.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Minimum 0.02" thick.

D. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Products, Division of ITW; Metal Jacketing Systems.
   b. PABCO Metals Corporation; Surefit.
   c. RPR Products, Inc.; Insul-Mate.

E. Aluminum Jacket: A 0.016", stucco-embossed, self-adhering, aluminum jacket shall be used on straight runs with fittings to match. Overlap shall be 2" minimum with joints positioned to shed water and be completely weather sealed.

2.7 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1" by 1", PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040" thick, minimum 1" by 1", aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

2.8 FITTING COVERS/INSULATION

A. Products: Subject to compliance with requirements. Provide one of the following:

   1. HamFAB (Leighton, PA)
   2. Elolux (Astoria, NY)
B. Preformed fiberglass, mitered fiberglass, calcium silicate. Protect fittings by field applied fitting covers as necessary. Loose packed and wrapped insulation covered with plastic fitting covers is not acceptable.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3" wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4" o.c.
3. Overlap jacket longitudinal seams at least 1-1/2". Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge.
   a. For below ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4" beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices
2. Testing agency labels and stamps
3. Nameplates and data plates
4. Cleanouts

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2" below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2".
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2".

1. Comply with requirements in Division 07 Section "Penetration Firestopping" firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2".
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.4 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
   a. Do not weld anchor pins to ASME-labeled pressure vessels.
   b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
   c. On tanks and vessels, maximum anchor-pin spacing is 3" from insulation end joints, and 16" o.c. in both directions.
   d. Do not overcompress insulation during installation.
   e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
   f. Impale insulation over anchor pins and attach speed washers.
   g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6" from each end. Install wire or cable between two circumferential girdles 12" o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48" o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3".
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.
C. Insulation Installation on Pumps

1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6" centers, starting at corners. Install 3/8" diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.

2. Fabricate boxes from galvanized steel.

3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a
bther mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2” over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."
3.7 BOILER BREECHING INSULATION SCHEDULE

A. Round, Exposed Breeching and Connector: High-temperature mineral-fiber blanket, 3" thick and 3-lb/cubic feet nominal density.

B. Round, Concealed Breeching and Connector Insulation: High-temperature mineral-fiber blanket, 3" thick and 3-lb/cubic feet nominal density.

3.8 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation
   1. Concealed and exposed supply and outdoor air.
   2. Concealed and exposed return located in nonconditioned space.
   3. Concealed and exposed supply and return.

B. Items Not Insulated
   1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
   2. Factory-insulated items.
   3. Flexible connectors.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed and exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2" thick and [0.75-lb/cu. ft.] [1.5-lb/cu. ft.] [3-lb/cu. ft.] nominal density.

B. Concealed and exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2" thick and [0.75-lb/cu. ft.] [1.5-lb/cu. ft.] [3-lb/cu. ft.] nominal density.

C. Concealed and exposed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber [blanket] [board], 2" [3"] thick and [1.5-lb/cu. ft.] [3-lb/cu. ft.] nominal density.

D. Concealed and exposed, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated [blanket] [board] [blanket or board]; thickness as required to achieve 2-hour fire rating.

E. Concealed and exposed exhaust air duct and plenum insulation: Mineral fiber blanket, 1-1/2" thick, and [0.75 lb/cu ft.] [1.5 lb/cu.ft.] [3 lb/cu.ft.] nominal density.

3.10 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.


3.11 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

C. Heat-Exchanger (Water-to-Water for Heating Service) Insulation: Mineral-fiber pipe and tank, 2" thick.

D. Dual-service heating and cooling pump insulation shall be one of the following:
   1. Cellular Glass: 3" thick.

E. Chilled-water expansion/compression tank insulation shall be one of the following:
   2. Flexible Elastomeric: 1" thick.

F. Dual-service heating and cooling expansion/compression tank insulation shall be one of the following:
   2. Flexible Elastomeric: 1" thick.


H. Air-separator insulation shall be one of the following:
   2. Flexible Elastomeric: 1" thick.

I. Insulate cold surfaces of chillers, including shell and water boxes, suction piping between chiller and compressor, motor (if water cooled), cold gas connection to motor (if gas cooled) and auxiliary piping with 1" thick flexible elastomeric. Paint any scratched or marred surfaces with a rust inhibitive paint.
3.12 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.13 INDOOR PIPING INSULATION SCHEDULE

A. Chilled Water and Brine, above 40 Deg F

2. Paint steel piping with two coats of impermeable black radiator paint #55-9681 Asphalt-Gilsonite as manufactured by Pruett Schaffer Chemical Co., Pittsburgh, PA, before applying insulation.

B. Heating-Hot-Water Supply and Return, 200 Deg F and below: Insulation shall be one of the following:


C. Refrigerant Suction and Hot-Gas Piping: Flexible elastomeric, 3/4" thick.

D. Refrigerant Suction and Hot-Gas Flexible Tubing: Flexible elastomeric, 3/4" thick.

E. Dual-Service Heating and Cooling, 40 to 200 Deg F: Insulation shall be the following:


F. Drain piping: 1/2" thick flexible elastomeric.

G. Insulate steam, condensate return, and (hot) vent piping with mineral-fiber, preformed pipe insulation of thickness as follows:
1. High and Medium Pressure Steam (20-150 psig), 350°F, 2" thick for pipe sizes 2" and smaller, 3" for pipe sizes from 2-1/2" to 4", 4" thick for pipe sizes 5" and above.
2. Low Pressure Steam (5-20 psig), 250°F, 1-1/2" thick for pipe sizes 2" and smaller, 2" for pipe sizes from 2-1/2" to 6", 4" thick for pipe sizes 8" and above.
3. High and Medium Pressure Returns, 350°F, 2" thick for all pipe sizes.
4. Low Pressure Returns, 200°F, 1" thick for all pipe sizes.
5. Pumped Condensate 180°F, 1" thick for all pipe sizes.
6. Hot Vents, 1" thick for all pipe sizes.

3.14 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Chilled Water and Brine: Insulation shall be one of the following:
   1. Cellular Glass: 3" thick.
   2. Flexible Elastomeric: 3" thick.
   3. Mineral-Fiber, Preformed Pipe Insulation, Type I: 3" thick.

B. Heating-Hot-Water Supply and Return, 200 Deg F and below: Insulation shall be one of the following:
   1. Cellular Glass: 3" thick.
   2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2" thick.

C. Refrigerant Suction and Hot-Gas Piping: Insulation shall be one of the following:
   2. Flexible Elastomeric: 1" thick.
   3. Mineral-Fiber, Preformed Pipe Insulation, Type I: _____" thick.

D. Refrigerant Suction and Hot-Gas Flexible Tubing: Insulation shall be the following:
   1. Flexible Elastomeric: 1" thick.

E. Dual-Service Heating and Cooling: Insulation shall be one of the following:
   1. Cellular Glass: 3" thick.
   2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2" thick.

F. Condenser Water Piping
   1. 2" minimum thick, performed mineral fiber insulation with aluminum jacketing.

3.15 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Loose-fill insulation, for below ground piping, is specified in Division 33 piping distribution Sections.

B. Chilled Water, All Sizes: Cellular glass, 2" thick.
C. Heating-Hot-Water Supply and Return, All Sizes, 200 Deg F and below: Cellular glass, 3" thick.

D. Dual-Service Heating and Cooling, All Sizes, 40 to 200 Deg F: Cellular glass, 3" thick.

3.16 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Exposed, up to 48" in Diameter or with Flat Surfaces up to 72".
   1. Aluminum, Smooth: [0.020"] [0.024"] thick.

D. Ducts and Plenums, Exposed, Larger Than 48" in Diameter or with Flat Surfaces Larger Than 72".
   1. Aluminum, Smooth: 0.040" thick.

E. Equipment, Exposed, up to 48" in Diameter or with Flat Surfaces up to 72".
   1. Aluminum, Smooth with Z-Shaped Locking Seam: [0.020"] [0.024"] thick.

F. Equipment, Exposed, Larger Than 48" in Diameter or with Flat Surfaces Larger Than 72".
   1. Aluminum, Smooth: 0.040" thick.

G. Piping, Exposed
   1. PVC: 20 mils thick.

3.17 Where pipe riser insulation is exposed in finished areas, provide 0.02" PVC jacketing with Zeston fittings to 7'-0" above finished floor.

3.18 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

3.19 METAL SHIELDS

A. Install metal shields between hangers or supports and the piping insulation. Install rigid insulation inserts between the pipe and the insulation shields. Use inserts of equal thickness to the adjacent insulation and vapor seal each insert. Insulation inserts shall be no less than the following lengths:

   1-1/2" to 2-1/2" IPS 10" long
3.20 Replace all existing insulation damaged due to installation of new work, alterations, etc.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

B. See Division 23 Section "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.

1.2 SUBMITTALS

A. Product Data: For each control device indicated.

B. Shop Drawings

1. Schematic flow diagrams.
2. Power, signal, and control wiring diagrams.
3. Details of control panel faces.
4. Damper schedule.
5. Valve schedule.
6. DDC System Hardware: Wiring diagrams, schematic floor plans, and schematic control diagrams.
7. Control System Software: Schematic diagrams, written descriptions, and points list.

C. Software and firmware operational documentation.

D. Field quality-control test reports.

E. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
2.2 CONTROL SYSTEM

A. Manufacturers
   1. Schneider Electric

B. Installers
   Control Systems Inc.
   Hagerstown, MD 21701

C. Control system shall be web based with full access via the world-wide web.

D. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.

E. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

2.3 DDC EQUIPMENT

A. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.

   1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation.

   2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
      a. Global communications.
      b. Discrete/digital, analog, and pulse I/O.
      c. Monitoring, controlling, or addressing data points.
      d. Software applications, scheduling, and alarm processing.
      e. Testing and developing control algorithms without disrupting field hardware and controlled environment.

B. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.

   1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.

   2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
      a. Global communications.
      b. Discrete/digital, analog, and pulse I/O.
      c. Monitoring, controlling, or addressing data points.

   3. Local operator interface provides for download from or upload to operator workstation.
C. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.

1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
7. Universal I/Os: Provide software selectable binary or analog outputs.

D. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:

1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

E. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:

1. Minimum dielectric strength of 1000 V.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.4 UNITARY CONTROLLERS

A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.

1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bio; and 72-hour battery backup.
2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. [Perform scheduling with real-time clock.] Perform automatic system diagnostics; monitor system and report failures.
3. Enclosure: Dustproof rated for operation at 32 to 120 deg F.
2.5 ANALOG CONTROLLERS

A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.

B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F, and single- or double-pole contacts.

C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.

1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.

D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.

2.6 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. Thermistor Temperature Sensors and Transmitters

1. Manufacturers
   a. Ebtron, Inc.
   b. Heat-Timer Corporation
   c. MAMAC Systems, Inc.
   d. RDF Corporation

2. Accuracy: Plus or minus \([0.5 \text{ deg F}] \pm 0.36 \text{ deg F}\) at calibration point.


4. Insertion Elements in Ducts: Single point, \([8 \text{ inches}] \pm 18 \text{ inches}\) long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.

5. Averaging Elements in Ducts: \([36 \text{ inches long, flexible}] \pm 72 \text{ inches long, flexible}\); use where prone to temperature stratification or where ducts are larger than 10 sq. ft.

6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.

7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
   a. Set-Point Adjustment: \([\text{Concealed}] \pm \text{Exposed}\).
   b. Set-Point Indication: \([\text{Concealed}] \pm \text{Keyed}] \pm \text{Exposed}\).
   c. Thermometer: \([\text{Concealed}] \pm \text{Exposed}\).

8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.


C. RTDs and Transmitters
1. Manufacturers  
   a. MAMAC Systems, Inc.  
   b. RDF Corporation

2. Accuracy: Plus or minus 0.2 percent at calibration point.


4. Insertion Elements in Ducts: Single point, [8 inches] [18 inches] long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.

5. Averaging Elements in Ducts: [18 inches long, rigid] [24 inches long, rigid] [48 inches long, rigid] [24 feet long, flexible]; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.

6. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.

7. Room Sensor Cover Construction: Manufacturer's standard locking covers.  
   a. Set-Point Adjustment: [Concealed] [Exposed].  
   b. Set-Point Indication: [Concealed] [Keyed] [Exposed].  
   c. Thermometer: [Concealed] [Exposed].

8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.


D. Humidity Sensors: Bulk polymer sensor element.

1. Manufacturers  
   a. MAMAC Systems, Inc.  
   b. ROTRONIC Instrument Corp.  
   c. TCS/Basys Controls


3. Room Sensor Range: 20 to 80 percent relative humidity.

4. Room Sensor Cover Construction: Manufacturer's standard locking covers.  
   a. Set-Point Adjustment: [Concealed] [Exposed].  
   b. Set-Point Indication: [Concealed] [Keyed] [Exposed].  
   c. Thermometer: [Concealed] [Exposed].

5. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.

6. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of [32 to 120 deg F] [minus 22 to plus 185 deg F] [minus 40 to plus 170 deg F].

7. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.

E. Pressure Transmitters/Transducers

1. Manufacturers  
   a. MAMAC Systems, Inc.  
   b. ROTRONIC Instrument Corp.  
   c. TCS/Basys Controls

2. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.  
   a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.  
   b. Output: 4 to 20 mA.  
   c. Building Static-Pressure Range: 0- to 0.25-inch wg.  
   d. Duct Static-Pressure Range: 0- to 5-inch wg.
3. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.
4. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.
5. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
6. Pressure Transmitters: Direct acting for gas or liquid service; range suitable for system; linear output 4 to 20 mA.

F. Room Sensor Cover Construction: Manufacturer's standard locking covers.
   1. Set-Point Adjustment: [Concealed] [Exposed].
   2. Set-Point Indication: [Concealed] [Keyed] [Exposed].
   3. Thermometer: [Concealed] [Exposed].

G. Room sensor accessories include the following:
   1. Insulating Bases: For sensors located on exterior walls.
   2. Guards: [Locking; heavy-duty, transparent plastic; mounted on separate base] [Metal wire, tamperproof] [Locking, solid metal, ventilated].
   3. Adjusting Key: As required for calibration and cover screws.

2.7 STATUS SENSORS

A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg.

B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig, piped across pump.

C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

D. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.

E. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.

F. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.

G. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

H. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.
2.8 THERMOSTATS

A. Manufacturers

1. Erie Controls
3. Heat-Timer Corporation

B. Electric, solid-state, microcomputer-based room thermostat with remote sensor.

1. Automatic switching from heating to cooling.
2. Preferential rate control to minimize overshoot and deviation from set point.
3. Set up for four separate temperatures per day.
4. Instant override of set point for continuous or timed period from 1 hour to 31 days.
5. Short-cycle protection.
6. Programming based on [weekday, Saturday, and Sunday] [every day of week].
7. Selection features include degree F display, 12- or 24-hour clock, keyboard disable, remote sensor, and fan on-auto.
8. Battery replacement without program loss.
9. Thermostat display features include the following:
   a. Time of day
   b. Actual room temperature
   c. Programmed temperature
   d. Programmed time
   e. Duration of timed override
   f. Day of week
   g. System mode indications include "heating," "off," "fan auto," and "fan on"

C. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.

D. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.

1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.

E. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.

1. Bulbs in water lines with separate wells of same material as bulb.
2. Bulbs in air ducts with flanges and shields.
3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.
4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.

5. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.

6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.

F. Fire-Protection Thermostats: Listed and labeled by an NRTL acceptable to authorities having jurisdiction; with fixed or adjustable settings to operate at not less than 75 deg F above normal maximum operating temperature, and the following:

2. Reset: Automatic, with control circuit arranged to require manual reset at central control panel; with pilot light and reset switch on panel labeled to indicate operation.

G. Room Thermostat Cover Construction: Manufacturer's standard locking covers.

1. Set-Point Adjustment: [Concealed] [Exposed].
2. Set-Point Indication: [Concealed] [Keyed] [Exposed].
3. Thermometer: [Concealed] [Exposed].

H. Room thermostat accessories include the following:

1. Insulating Bases: For thermostats located on exterior walls.
2. Thermostat Guards: [Locking; heavy-duty, transparent plastic; mounted on separate base] [Metal wire, tamperproof] [Locking, solid metal, ventilated].
3. Adjusting Key: As required for calibration and cover screws.
4. Set-Point Adjustment: 1/2-inch- diameter, adjustment knob.

I. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable set point.

J. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.

K. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.

2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

L. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above set point.

2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

M. Heating/Cooling Valve-Top Thermostats: Proportional acting for proportional flow, with molded-rubber diaphragm, remote-bulb liquid-filled element, direct and reverse acting at
minimum shutoff pressure of 25 psig, and cast housing with position indicator and adjusting knob.

2.9 HUMIDISTATS

A. Manufacturers
1. MAMAC Systems, Inc.
2. ROTRONIC Instrument Corp.

B. Duct-Mounting Humidistats: Electric insertion, 2-position type with adjustable, 2 percent throttling range, 20 to 80 percent operating range, and single- or double-pole contacts.

2.10 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

1. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
3. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
4. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

1. Manufacturers
   a. Belimo Aircontrols (USA), Inc.
2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
3. Dampers: Size for running torque calculated as follows:
   b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
   c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. of damper.
   d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
   e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
   f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.

5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
7. Power Requirements (Two-Position Spring Return): \([24] [120] [230]\)-V ac.
8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
10. Temperature Rating: \([-22 \text{ to plus } 122 \text{ deg F}] [40 \text{ to } 104 \text{ deg F}]\).
11. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
12. Run Time: \([12 \text{ seconds open, } 5 \text{ seconds closed}] [30 \text{ seconds}] [60 \text{ seconds}] [120 \text{ seconds}]\).

2.11 CONTROL VALVES

A. Manufacturers

2. Erie Controls
3. Magnatrol Valve Corporation
4. Neles-Jamesbury

B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

C. Hydronic system globe valves shall have the following characteristics:

1. NPS 2 and Smaller: Class [125] [250] bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
2. NPS 2-1/2 and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.
   a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
   b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.
4. Sizing: [3-psig] [5-psig] maximum pressure drop at design flow rate or the following:
   b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.
   c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.
5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.

D. Butterfly Valves: 200-psig, 150-psig maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
1. Body Style: [Wafer] [Lug] [Grooved].
2. Disc Type: [Nickel-plated ductile iron] [Aluminum bronze] [Elastomer-coated ductile iron] [Epoxy-coated ductile iron].
3. Sizing: 1-psig maximum pressure drop at design flow rate.

E. Terminal Unit Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.
   1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
   2. Sizing: 3-psig maximum pressure drop at design flow rate, to close against pump shutoff head.
   3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

F. Self-Contained Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.
   1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
   2. Thermostatic Operator: [Wax] [Liquid]-filled [integral] [remote] sensor with [integral] [remote] adjustable dial.

2.12 DAMPERS

A. Manufacturers
   1. Air Balance Inc.
   2. Vent Products Company, Inc.

B. Dampers: AMCA-rated, [parallel] [opposed]-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.
   1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with [oil-impregnated sintered bronze] [nylon] blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
   2. Operating Temperature Range: From minus 40 to plus 200 deg F.
   3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
   4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. x lbf; when tested according to AMCA 500D.

2.13 CONTROL CABLE

A. Electronic and fiber-optic cables for control wiring are specified in Division 27 Section "Communications Horizontal Cabling."
PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above the floor.

   1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

B. Install guards on thermostats in the following locations:

   1. Entrances
   2. Public areas
   3. Where indicated

C. Install automatic dampers according to Division 23 Section "Air Duct Accessories."

D. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

E. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."

F. Install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."

G. Install refrigerant instrument wells, valves, and other accessories according to Division 23 Section "Refrigerant Piping."

H. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.

I. Install electronic and fiber-optic cables according to Division 27 Section "Communications Horizontal Cabling."

3.2 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Install signal and communication cable according to Division 27 Section "Communications Horizontal Cabling."

   1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
   2. Install exposed cable in raceway.
   3. Install concealed cable in raceway.
   4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
   
1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. Test each point through its full operating range to verify that safety and operating control set points are as required.
5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

C. DDC Verification

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
6. Check temperature instruments and material and length of sensing elements.
7. Check control valves. Verify that they are in correct direction.
8. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
9. Check DDC system as follows:
   a. Verify that DDC controller power supply is from emergency power supply, if applicable.
   b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
   c. Verify that spare I/O capacity has been provided.
d. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes control sequences for HVAC systems, subsystems, and equipment.

B. See Division 23 Section "Instrumentation and Control for HVAC" for control equipment and devices and for submittal requirements.

1.2 HOT WATER SYSTEM

A. Hot Water System

1. A separate reset schedule shall be provided for radiation loop. Control shall be by the three-way bypass valve. This schedule shall track the primary reset schedule and be 10°F lower than the primary. Whenever outside temperature is below 60°F, the selected lead hot water secondary pump SHW-1 shall energize. If flow fails on the lead pump, an alarm shall be provided through the BAS. Secondary pump rotation shall be selected from lead/lag switch.

2. Whenever the outside temperature is below 60°F., the selected lead hot water secondary pump SHW-2 for the air handling unit loop shall energize. If flow fails on the lead pump, an alarm shall be provided through the BAS. Control for air handling unit loop shall be by three-way valves at each air handling unit.

B. Sequence of Operation – Hot Water System

1. Whenever the outside temperature is below 60°F, the selected lead hot water pump shall energize. If flow fails on the lead pump, an alarm shall be provided through the BAS.

1.3 ENERGY RECOVERY UNITS

A. The heat recovery units will be controlled by a programmable controller. This controller can operate in a standalone mode or will receive setpoints and schedules from the DDC system.

B. The DDC system shall operate the heat recovery unit based on occupied-unoccupied cycle. "Occupied" signal will open the outside air damper and the exhaust air damper to fully open before the supply fan can start. The exhaust fan will be interlocked with the supply fan to operate when the supply fan operates. Supply and return fans will be variable speed and the speed will be modulated as required to maintain static pressure setpoint in the respective ductwork.

C. The unit shall operate off of a space temperature and humidity transmitters and shall control the DX Cooling, Hot Gas Reheat, and Heating Hot Water coil accordingly to maintain a space condition of 72 deg F at 50% RH. A night setback will be used during "unoccupied" cycle.
D. Internal bypass dampers will permit outside air to bypass the heat recovery wheel whenever outside air is increased for economizer cycle and will direct all return air through the exhaust duct. The wheel will be stopped during economizer cycle.

E. Smoke detectors located in supply air and return air ducts on sensing a smoke condition will de-energize the fans and close the smoke dampers.

F. Dehumidification for rooftop units: When the space humidity for systems is above its setpoint (50% RH), the rooftop unit DDC controller shall energize the DX compressor system to provide supply air dehumidification. The unit hot gas reheat shall be controlled to maintain discharge temperatures.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

   1. Hot-water heating piping

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification sections, apply to this Section.

C. See Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.

1.2 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:

   1. Hot-Water Heating Piping: 125 psig at 200 deg F.

B. Reference Standards

   1. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
   2. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
   3. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
      a. ANSI/ASME Sec 9   Welding and Brazing Qualifications.
      c. ANSI/ASME B16.3   Malleable Iron Threaded Fittings Class 150 and 300.
      e. ANSI/ASME B16.23 – Cast Copper Alloy Solder Drainage Fitting – DWV.
      f. ANSI/ASME B16.29 – Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings – DWV.
      g. ANSI/ASME B31.9   Building Services Piping.
      h. ASME B36.1 – Standardization of dimensions of welded and seamless wrought steel pipe for high or low temperatures and pressures.
      i. ANSI/AWS D1.1   Structural Welding Code.
      j. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses.
l. ASTM A106 Grade B, Seamless piping.
m. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

1.3 SUBMITTALS

A. Product Data: For each type of the following:
   1. Piping materials, joints, and fittings.
   2. Hydronic specialties.
   3. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
   4. Air control devices.

B. Delegated-Design Submittal
   1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
   2. Locations of pipe anchors and alignment guides and expansion joints and loops.
   3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.
   4. Locations of and details for penetration and firestopping for fire- and smoke-rated wall and floor and ceiling assemblies.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

B. Installer Qualifications
   1. Installers of Pressure-Sealed Joints: Installers shall be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.
C. U.S. Steel: Use only steel products, rolled, formed, shaped, drawn, extruded, forged, cast, fabricated, or otherwise similarly, processed, or processed by a combination of two or more of such operations, from steel made in the United States. The Contractor must submit certification which satisfies the Owner that the Contractor has fully complied with this provision. [Optional]

D. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

E. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1.5 DELIVERY, STORAGE AND HANDLING

A. Provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.

B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproofing wrapping.

C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Anvil International, Inc.
      b. Tyco Fire Products, LP; Grinnell
      c. Victaulic Company of America.
   2. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting.
   3. Grooved-End-Tube Couplings: Rigid pattern, unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, EPDM gasket rated for minimum 230 deg F for use with housing, and steel bolts and nuts.
2.2 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8" maximum thickness unless thickness or specific material is indicated.
   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

C. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

2.3 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Shall not be used.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric Couplings

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Calpico, Inc.
   b. Lochinvar Corporation.
   c. Epco.

2. Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.4 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "Instrumentation and Control for HVAC."

C. Diaphragm-Operated, Pressure-Reducing Valves
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett Domestic Pump; a division of ITT Industries.
   d. Conbraco Industries, Inc.
   e. Spence Engineering Company, Inc.
   f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Low inlet-pressure check valve.
8. Inlet Strainer: removable without system shutdown.
10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

2.5 AIR CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Amtrol, Inc.
   2. Armstrong Fluid Technology
   3. Bell & Gossett; a Xylem brand
   4. Taco, Inc.
   5. Spirotherm, Inc.
B. Manual Air Vents
   1. Body: Bronze.
   2. Internal Parts: Nonferrous.
   3. Operator: Screwdriver or thumbscrew.
   4. Inlet Connection: NPS 1/2.
   7. Maximum Operating Temperature: 225 deg F.
C. Automatic Air Vents
   1. Body: Bronze.
   2. Internal Parts: Nonferrous.
   5. Discharge Connection: NPS 1/2.
   7. Maximum Operating Temperature: 240 deg F.
2.6 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers
   1. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:
      a. Spirax Sarco, Inc.
      b. Watts Water Technologies
      c. Victaulic Company
   2. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
      Strainers for city water piping: bronze body.
   3. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
   4. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
   5. CWP Rating: 125 psig.

B. Expansion fittings are specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

2.7 BALANCING VALVES AND INSTRUMENTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Bell & Gossett; a Xylem Brand
   2. IMI Flow Design, a brand of IMI Hydronic Engineering, Inc.
   3. Nexus Valve
   4. Victaulic Company

B. Manual Balancing Valve Sizes 1/2" to 2" (NPT or Solder Connections)
   1. Furnish and install, as shown on the plans, balancing valves with provision for connecting a portable differential (Ft. of Head) pressure meter. Each meter shall have pressure/temperature probes.
   2. The balancing valves shall be Y-pattern globe style or ball design and all metal parts of nonferrous, pressure die cast, nonporous Ametal. Each valve shall provide four (4) functions:
      a. Precise flow measurement
      b. Precision flow balancing
      c. Positive shut-off with no drip seat
      d. Drain connection using 3/4" NPT hose end thread.
   3. Valves shall have four (4) 360° adjustment turns of the handwheel for precise setting with hidden memory to provide a tamper-proof balancing setting. The handwheel can be installed in any position without affecting performance.

C. Manual Balancing Valve Sizes 2-1/2 to 12" (Flanged or Grooved Connections)
   1. Furnish and install, as shown on the plans, balancing valves with provision for connecting a portable differential (Ft. of Head) pressure meter. Each meter connection shall have pressure/temperature probes.
2. The balancing valves shall be Y-pattern globe style design or with Pitot Tube Butterfly design iron body all other wetted parts of nonferrous, pressure die cast Ametal. Each valve shall provide three (3) functions:
   a. Precision flow measurement
   b. Precision flow balancing
   c. Shut-off feature, eliminating the need of an additional isolation valve.
3. These valves shall have eight (8), twelve (12), sixteen (16), twenty (20) or twenty-two (22) 360° adjustment turns of the handwheel for precise setting with hidden memory feature to program the valve with precision tamper-proof balancing setting. Handwheel shall have digital readout. The handwheel can be installed in any position without affecting performance.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS
A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:
   1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered pressure-seal joints.
   2. Schedule 40 steel pipe; Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.
B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
   1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered.
   2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
   3. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.

3.2 VALVE APPLICATIONS
A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.
B. Install manual balancing valves at each branch connection to return main.
C. Install manual balancing valves in the return pipe of each heating or cooling terminal.
D. Install check valves at each pump discharge and elsewhere as required to control flow direction.
E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.
F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.
3.3 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Piping shall be located as close as possible to the location shown on the drawings. Should conflicts or unforeseen conditions arise, the contractor shall either submit a proposed alternate routing for approval, or contact the Engineer for further direction.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Piping shall not pass exposed through electrical rooms or be erected over any switch board or other electrical gear.
   1. Where conflicts are unavoidable, stainless steel drain pans with drain lines piped to an approved waste receptor may be provided pending written approval from the Owner.

E. Install piping to permit valve servicing.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Install piping to permit valve servicing.

H. Install piping at indicated slopes.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Install piping to allow application of insulation. Provide 2" clearance between insulated piping and other obstructions.

L. Select system components with pressure rating equal to or greater than system operating pressure.

M. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

N. Select system components with pressure rating equal to or greater than system operating pressure.

O. Unions
   1. No union shall be placed in a location which will be inaccessible.
   2. Unions, grooved, or flanged fittings shall be installed adjacent to all equipment for repair and replacement. Installation of fitting must facilitate maintenance and removal access without dismantling or draining the piping system beyond the equipment isolation valves. Select system components with pressure rating equal to or greater than system operating pressure.
P. Install manual air vents at all locations that form local air traps to facilitate system fill.

Q. Install automatic air vents with isolation valve at the highest point in each system. Air vent shall be rated for the system temperature, pressure and water chemistry. Where feasible, automatic air vents installed in glycol systems must be routed to the main recovery tank.

R. All piping shall be arranged to completely drain the system. Drain locations shall be located at all system low points. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

S. Reduced pressure principal back flow preventers shall be installed on all make-up water lines.

T. Bull-heading tee connections are prohibited. Main fluid flows shall not enter the side of a tee fitting and then diverge.

U. Correct leaks in piping immediately, using new materials. Leak-sealing compounds or preening is not permitted.

V. Install piping at a uniform grade of 0.2 percent upward in direction of flow for supply, downward in direction of flow for return.

W. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

X. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

Y. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."

Z. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

AA. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

BB. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

CC. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

DD. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing. Electrolysis control between dissimilar materials shall be achieved through the use of dielectric nipples and a non-dielectric union. Dielectric unions shall not be used.
B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples.
C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric nipples.
D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.

B. Restraints are specified in Division 23 Section "Vibration and Controls for HVAC Piping and Equipment."

C. Install the following pipe attachments:
   1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
   2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
   3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
   4. Spring hangers to support vertical runs.
   5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
   1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4".
   2. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4".
   3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8".
   4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8".
   5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8".
   6. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8".
   7. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2".

E. Install hangers for drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:
   1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4".
   2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4".
   3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8".
   4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8".
   5. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8".
   6. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8".

F. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.
G. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.6 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA’s "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gages for HVAC Piping."

3.8 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:
   1. Leave joints, including welds, uninsulated and exposed for examination during test.
   2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
   3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.

5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.

2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.

3. Isolate expansion tanks and determine that hydronic system is full of water.

4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."

5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.

2. Inspect pumps for proper rotation.

3. Set makeup pressure-reducing valves for required system pressure.

4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).

5. Set temperature controls so all coils are calling for full flow.

6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.

7. Verify lubrication of motors and bearings.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   2. Close-coupled, end-suction centrifugal pumps.

1.2 SUBMITTALS

A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

A. Manufacturers

   1. Bell & Gossett; Div. of ITT Industries, Series 60.
2. Taco, Inc.
3. Armstrong Pumps Inc.
4. Aurora Pump; Division of Pentair Pump Group.
5. Grundfos Pumps Corporation.
6. PACO Pumps.
7. Weinman; Div. of Crane Pumps & Systems.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump; designed for installation with pump and motor shafts mounted horizontally or vertically. Rate pump for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.

C. Pump Construction

1. Casing: Radially split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, and threaded companion flange connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and EPT bellows and gasket. Include water slinger on shaft between motor and seal.
5. Packing Seal: Stuffing box, with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.

D. Motor: Single speed, 1750 rpm, with permanently lubricated ball bearings, unless otherwise indicated; and rigidly mounted to pump casing. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.3 CLOSE-COUPLED, END-SUCTION CENTRIFUGAL PUMPS

A. Manufacturers

1. Bell & Gossett; Div. of ITT Industries, Series 80.
2. Taco, Inc.
3. Armstrong Pumps Inc.
4. Aurora Pump; Division of Pentair Pump Group.
5. PACO Pumps.
6. Weinman; Div. of Crane Pumps & Systems.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, end-suction pump; designed for installation with pump and motor shafts mounted horizontally. Rate pump for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.

C. Pump Construction
1. Casing: Radially split, cast iron, with replaceable bronze wear rings, drain plug at bottom and air vent at top of volute, threaded gage tappings at inlet and outlet, and flanged connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and EPT bellows and gasket. Include water slinger on shaft between motor and seal.
5. Pump Bearings: Permanently lubricated ball bearings.
6. Motor: Single speed, 1750 rpm, with permanently lubricated ball bearings, unless otherwise indicated; rigidly mounted to pump casing with integral pump support. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.4 PUMP SPECIALTY FITTINGS (SUCTION DIFFUSERS)

A. Manufacturers

1. Bell and Gossett, Div. of ITT Industries
2. Armstrong Pumps, Inc.
3. Taco

B. Suction Diffuser: Angle pattern, **175-psig** pressure rating, cast-iron body and end cap, pump-inlet fitting; with bronze startup and bronze or stainless-steel permanent strainers; bronze or stainless-steel straightening vanes; drain plug; and factory-fabricated support. Disposable fine mesh startup filter shall be removed after 30 days of operation. Pressure drop shall not exceed 1 psi at specified flow. Free area shall be no less than five times suction area of pump connection.

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

A. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.

B. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

C. Install continuous-thread hanger rods and spring hangers of sufficient size to support pump weight. Vibration isolation devices are specified in Division 23 Section "Vibration Controls for HVAC Piping and Equipment." Fabricate brackets or supports as required. Hanger and support materials are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

D. Suspend vertically mounted, in-line centrifugal pumps independent of piping. Install pumps with motor and pump shafts vertical. Use continuous-thread hanger rods and spring hangers of sufficient size to support pump weight. Vibration isolation devices are specified in Division 23
Section "Vibration Controls for HVAC Piping and Equipment." Hanger and support materials are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

E. Set base-mounted pumps on concrete foundation. Disconnect coupling before setting. Do not reconnect couplings until alignment procedure is complete.

1. Support pump baseplate on rectangular metal blocks and shims, or on metal wedges with small taper, at points near foundation bolts to provide a gap of 3/4 to 1-1/2 inches between pump base and foundation for grouting.
2. Adjust metal supports or wedges until pump and driver shafts are level. Check coupling faces and suction and discharge flanges of pump to verify that they are level and plumb.
3. Securely attach each pump assembly to concrete pad or specified foundation.

F. Provide each pump with a coupler guard conforming to ANSI B15.1.

3.2 ALIGNMENT

A. Align pump and motor shafts and piping connections after setting on foundation, grout has been set and foundation bolts have been tightened, and piping connections have been made.

B. Comply with pump and coupling manufacturers' written instructions.

C. Adjust pump and motor shafts for angular and offset alignment by methods specified in HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."

D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

E. Prior to starting of pumps, retain a factory trained service technician to align each pump. Upon completion of alignment, submit letter to Owner's representative stating alignment has been completed according to contract requirements.

F. Install a larger or smaller impeller if needed, to attain desired water flow rate for balancing.

G. Verify available NPSH for condenser water pumps. Notify Engineer if NPSH is insufficient to meet pump NPSHR.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

E. Install triple-duty valve on discharge side of pumps.
F. Install suction diffuser and shutoff valve on suction side of pumps.

G. Provide a stainless steel braided type flexible connector in every pump suction and discharge, as close to the pump as possible to absorb vibration and prevent noise transmission. Flex connectors shall be as manufactured by Keflex, or Metraflex for the temperatures and working pressures of the systems being installed.

H. Install pressure gages on pump suction and discharge, at integral pressure-gage tapping, or install single gage with multiple input selector valve.

I. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

J. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

K. Provide drains for bases and stuffing boxes pipes to and discharging into floor drains.

L. Provide air vent and drain connection on horizontal pump casings.

M. Each pump shall be furnished with one spare set of bearings and a spare coupling, which shall be delivered to the Owner. Verification of delivery, in writing, shall be obtained from the Owner, with a copy delivered to the Architect. [Delete this requirement for small projects.]

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.2 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment. Schematic refrigerant piping diagram shall be prepared by same manufacturer as equipment served.

1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

C. Field quality-control test reports.

1.3 QUALITY ASSURANCE


B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.4 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 PIPING

A. Use clean, hard drawn, factory plugged type ACR (air conditioning refrigeration) copper tubing with wrought copper fittings. Installation of refrigerant piping requires that refrigerant piping be silver soldered. Therefore, it is incumbent that the Contractor provides valves and specialties which can be silver soldered without damaging internal
parts. Disassemble valves and specialties before soldering. Appeal of this requirement after installation is completed will not be considered and work not conforming to specifications will be directed to be replaced. Silver solder composition: 15% silver, 80% copper, 5% miscellaneous metals and shall have maximum melting point of 1160°F. SIL-FOS as manufactured by Handy & Harmon, J.W. Harris Co., Inc., or equivalent. Do not use lead or tin base solders. Final connections of refrigerant lines of 1/2" O.D. and under may be made with flare fittings.

B. Refrigerant piping and equipment shall be installed by qualified mechanics, who have had at least two years experience in refrigeration installation.

C. Copper tubing becomes greatly oxidized when subject to temperatures required for silver soldering and/or low temperature brazing. Oxidation within the copper tubing is detrimental to refrigeration systems. Immediately prior to soldering, purge the piping with nitrogen. Upon completion, test and evacuate system to within 2 millimeters of mercury and charge. After system is in operation for two weeks, contact the Owners Representative and in the presence of the Owners Representative remove the cartridges from the liquid line and suction line filter driers to demonstrate that purging and soldering was properly carried out. If oxidation is found, flush the system with the Freon II method until clean.

2.2 VALVES


2.3 SIGHTGLASSES

A. Install sightglasses in liquid line serving each DX coil, and use double ported type having sightglass sealed into forged bronze body. SEE-ALL model as manufactured by Sporlan, Superior Valve, Henry Valve Co or equivalent.

2.4 FILTER-DRIERS

A. Install filter-driers: Refrigerant type installed in liquid line near each cooling coil with flared ends. Size filter-drier as recommended by manufacturer for service and capacity of system; connection size not less than line in which installed.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.
3.2 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Reroute piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and not interfere with use of space.

D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

E. Provide non-conducting dielectric connections when joining dissimilar metals.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance for installation of insulation and access to valves and fittings.

H. Provide access to concealed valves and fittings.

I. Shutoff valves shall be provided on all lines at the condensing units and the cooling coils.

J. Insulate piping; refer to Section 230700.

K. Fully charge completed system with refrigerant after testing.

L. System shall be complete with necessary shutoff valves, purge valves, charging valves, liquid line solenoid valve, sight glasses, dryers, vents, traps, fittings, and other accessories required for a complete installation. Refrigerant piping shall be sized as recommended by the equipment manufacturer, and based on total friction loss equivalent to not more than 2 degrees F for hot gas line, and 1 degree F for liquid line. Refrigeration piping shall be hard temper Type L copper tubing assembled with long radius wrought copper solder end fittings or SAE fittings. Refrigeration lines shall be properly supported.

M. The Contractor shall include initial startup of the system, final checkout and instruction to the Owner's operating personnel. Maintenance service for the refrigerant piping system shall also be included in the Contractor's bid for the first year from date of final acceptance by the Owner. The exact arrangement, sizes and other details shall be in strict accordance with the equipment manufacturer's diagrams which shall be submitted for approval.

3.3 APPLICATION

A. Provide line size liquid indicators in liquid line.

B. Provide filter-driers in liquid lines with flared connection.
C. Submit shop drawings on refrigeration equipment, complete wiring diagrams and refrigerant piping diagrams. Install wiring and piping in complete accordance with manufacturer's recommendations.

D. Refrigerant piping diagrams shown on the drawings are the minimum acceptable required piping and accessories and generally show single piping circuits. During bidding stages, obtain circulating requirements of various refrigeration equipment vendors and include costs for installation of piping and accessories in bid proposal.

E. Provide access fittings in piping system at suction line near each DX coil.

3.4 FIELD QUALITY CONTROL

A. Refrigerant piping and equipment shall be installed by qualified mechanics, who have had at least two years experience in refrigeration installation.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Rectangular ducts and fittings
   2. Round ducts and fittings
   3. Sheet metal materials
   4. Sealants and gaskets
   5. Hangers and supports

B. Related Sections

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
3. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal
   1. Sheet metal thicknesses.
   2. Joint and seam construction and sealing.
   3. Reinforcement details and spacing.
   4. Materials, fabrication, assembly, and spacing of hangers and supports.

D. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
   2. Suspended ceiling components.
   3. Structural members to which duct will be attached.
   4. Size and location of initial access modules for acoustical tile.
   5. Penetrations of smoke barriers and fire-rated construction.
   6. Items penetrating finished ceiling including the following:
      a. Lighting fixtures
      b. Air outlets and inlets
      c. Speakers
      d. Sprinklers
      e. Access panels
      f. Perimeter moldings
   7. Ductwork shall not be installed until all contractors have signed off on coordination drawings.

E. Welding certificates.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 LOW VELOCITY DUCTWORK (2 INCH WG POSITIVE OR NEGATIVE AND VELOCITIES LESS THAN 2000 FPM)

A. All low velocity ductwork shall be constructed and installed in strict accordance with the recommendations and details of SMACNA (Sheet Metal and Air Conditioning Contractors' National Association, Inc., 8224 Old Courthouse Road, Tysons Corner, Vienna, Virginia 22180), except where these Specifications exceed SMACNA requirements. Low velocity ductwork shall consist of outdoor intake ducts, supply ducts, exhaust ducts, transfer ducts, relief air ducts, and return ducts. Do not use snap lock stove pipe type round ducts, adjustable elbows, dovetail or spin connections.

B. No variation of duct configuration or sizes permitted except by written permission of Engineer where NC levels are critical such as theaters.

C. All miscellaneous transitions, shapes and accessories have not been indicated due to the scale of the Drawings; however, the Contractor shall install all sheet metal accessories to complete the systems. Special care shall be exercised to provide tight fitting, well-fabricated well-braced ductwork systems. Adjustment mechanisms, controls and dampers of all kinds must be accessible.

D. Drive slip joints shall not be used for joint connections unless the Contractor thoroughly tapes each joint with 3M or approved equal 4" wide vinyl impregnated cloth duct tape with adhesive back. Two 2" wide overlapped tapes may be used in lieu of 4" wide tape. Taped drive slip joints may be used on ducts up to and including 18" only.

E. All new low velocity ductwork shall be constructed to SMACNA 2" wg pressure class standards and shall be neatly built, rigidly braced with structural shapes to prevent vibration and made up of the following gauges: Exposed ductwork shall be one (1) gauge heavier than that listed.

<table>
<thead>
<tr>
<th>Steel Gauge</th>
<th>Aluminum Thickness</th>
<th>Maximum Size, Inches</th>
<th>Type of Transverse Joint Connections</th>
<th>Bracing</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>.020&quot;</td>
<td>Up to 12</td>
<td>Plain S Slip, Pocket Lock or Bar Slips on 8'-0&quot; Centers</td>
<td>None</td>
</tr>
<tr>
<td>24</td>
<td>.025&quot;</td>
<td>13 to 18</td>
<td>Plain S Slip, Pocket Lock or Bar Slips on 8'-0&quot; Centers</td>
<td>None</td>
</tr>
<tr>
<td>24</td>
<td>.025&quot;</td>
<td>19 to 30</td>
<td>Hemmed S Slip, 1&quot; Pocket Lock or 1&quot; Bar Slips on 10'-0&quot; Centers</td>
<td>1&quot; x 1&quot; x 1/8&quot; angles 5'-0&quot; OC max.</td>
</tr>
<tr>
<td>22</td>
<td>.032&quot;</td>
<td>31 to 42</td>
<td>1&quot; Pocket Lock or 1&quot; Bar Slips, on 5'-0&quot; Centers</td>
<td>1&quot; x 1&quot; x 1/8&quot; angles 5'-0&quot; OC max.</td>
</tr>
<tr>
<td>22</td>
<td>.032&quot;</td>
<td>43 to 54</td>
<td>1-1/2&quot; Angle Connections or</td>
<td>1-1/2&quot; x 1-1/2&quot; x</td>
</tr>
<tr>
<td>Steel Gauge</td>
<td>Aluminum Thickness</td>
<td>Maximum Size, Inches</td>
<td>Type of Transverse Joint Connections</td>
<td>Bracing</td>
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<tr>
<td>-------------</td>
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<td>---------</td>
</tr>
<tr>
<td>20</td>
<td>.040&quot;</td>
<td>55 to 60</td>
<td>1-1/2&quot; Pocket or 1-1/2&quot; Bar Slips on 5'-0&quot; Max. Centers</td>
<td>1/8&quot; angles 5'-0&quot; OC max.</td>
</tr>
<tr>
<td>20</td>
<td>.040&quot;</td>
<td>61 to 84</td>
<td>1-1/2&quot; Angle Connections or 1-1/2&quot; Bar Slips on 5'-0&quot; Max. Centers with 1-3/8&quot; x 1/8&quot; Bar Reinforcing</td>
<td>1-1/2&quot;x 1-1/2&quot; x 1/8&quot; angles 5'-0&quot; OC max.</td>
</tr>
<tr>
<td>18</td>
<td>.051&quot;</td>
<td>85 to 96</td>
<td>1-1/2&quot; Angle Pocket Connections or 1-1/2&quot; Angle Slips or 1-1/2&quot; Bar Slips 5'-0&quot; Max. Centers with 1-3/8&quot; x 3/16&quot; Bar Reinforcing</td>
<td>1-1/2&quot; x 1-1/2&quot; x 3/16&quot; angles 3'-0&quot; OC max.</td>
</tr>
<tr>
<td>18</td>
<td>.051&quot;</td>
<td>Over 96</td>
<td>2&quot; Angle Pocket Connections or 2&quot; Angle Slips 5'-0&quot; Maximum Centers with 2&quot; x 1/4&quot; Bar Reinforcing</td>
<td>2&quot; x 2&quot; x 1/4&quot; angles 2'-6&quot; OC max.</td>
</tr>
</tbody>
</table>

F. Round low velocity ductwork shall be fabricated of galvanized steel with lock-type spiral seams in accordance with SMACNA details and steel gauge thickness as listed in the SMACNA Manual. Duct system shall be as manufactured by United Sheet Metal, Semco, or approved equal.

G. All joints in ductwork shall be airtight and shall be constructed in accordance with SMACNA recommendations, except where SMACNA recommendations are exceeded by these Specifications. Seal all low pressure ducts with United McGill Duct seal for Seal Class B.

H. All connections between motor-operated equipment and ductwork shall be made through 20 oz. fire-resistant canvas throats, "Ventfab," "Durodyne," or approved equal. A short length of flexible duct (24" maximum) will be permitted to connect diffusers to low pressure ductwork. Flex duct and collar in duct shall be not less than diffuser collar size and held in place with strap or clamp.

I. All ductwork shall be supported by hanger straps, angles, rods, or bands, attached, sized and spaced in accordance with the SMACNA duct construction standards. Standard sheet metal practices listed and shown in the SMACNA "Duct Manual" shall apply to work to be performed.

J. Branch duct take-offs from rectangular ducts shall be full size bellmouth type (such as the Buckley Air-Tite Bellmouth Take-Off) with a heavy duty volume regulator for round branch ducts and 45° shoe tap type with volume regulator for rectangular branch ducts.

2.2 CASINGS
A. Fabricate casings in accordance with SMACNA Duct Construction Standards and construct for operating pressures indicated.

B. Mount floor mounted casings on concrete curbs. At floor, rivet panels on 8 inch centers to angles. Where floors of plenum are acoustically insulated, provide liner of 18 gauge galvanized expanded metal mesh supported at 12 inch centers, turned up 12 inches at sides with sheet metal shields.

C. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection. Provide clear wire glass observation ports, minimum 6 X 6 inch.

D. Fabricate acoustic casings with reinforcing turned inward. Provide 16 gauge back facing and 22 gauge perforated front facing with 3/32 inch diameter holes on 5/32 inch centers. Construct panels 3 inches thick packed with 4.5 lb/cu ft minimum glass fiber media, on inverted channels of 16 gauge.

2.3 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports

3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.
PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings. Duct sizes listed are inside dimensions. For lined ducts maintain sizes inside liner.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials

M. Set plenum doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.

N. Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for cleanout.
O. During construction provide temporary closures of metal or taped polyethylene or open ductwork to prevent construction dust from entering ductwork system.

P. Install flexible canvas connections at inlet and outlet of all fans. Flexible connections: UL Listed fire-retardant neoprene coated woven glass fabric to NFPA 90 approximately 6" wide crimped into metal edging strip. Where installed in outside atmosphere, use hypalon coated connections in lieu of neoprene coated. Provide minimum of 1" slack to insure that no vibration is transmitted.

Q. Do not use flexible ducts as elbows.

R. Do not use flexible ducts in return or exhaust duct systems.

S. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

T. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities. Do not install ducts above electrical panelboards, switchgear, or other electrical equipment.

U. Pack space between duct and masonry with UL approved mineral wool where ducts pass through floors or fire partitions.

V. At ductwork penetrations of exterior walls, pack space between duct and wall with UL approved mineral wool. Install proper size backer rod and caulk exterior exposure with silicone base caulking (1/2" minimum depth). Make seal weathertight.

W. In existing building: where existing cross-bracing interferes with duct installation, coordinate alterations to cross bracing with Architect.

X. At all duct shafts from Mechanical Rooms, seal spaces between ducts by caulking with loose fiberglass insulation faced with mastic. Large spaces shall be closed off with sound-lined 16 gauge galvanized sheet metal.

Y. All ductwork serving moisture laden or other condensable vapor laden air streams shall be sealed liquid tight to prevent leakage. Any leaking ductwork shall be replaced and all damage caused by leakage shall be the responsibility of the Contractor.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Return-Air Ducts: Seal Class B.
4. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
5. Unconditioned Space, Return-Air Ducts: Seal Class B.
6. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
7. Conditioned Space, Return-Air Ducts: Seal Class B.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.
E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 DUCT CLEANING

A. Clean existing duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.

2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.

3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.

2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).

2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.


5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.7 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.8 EXISTING BUILDINGS

A. Where existing cross-bracing interferes with duct installation, coordinate cross bracing alteration with Architect.

3.9 DUCT SYSTEM TESTING

A. Test duct systems after erection of system with all openings blanked. Systems shall be substantially airtight at this pressure. Provide blower, instruments, etc., necessary to establish results. Owner's Representative must be present at pressure test, and test results are subject to his approval. Previously test the system and maintain this test pressure before test is performed for approval of Owner's Representative.

B. All medium and high pressure duct systems shall be tested at 1-1/2 times operating pressure. Maximum allowable leakage shall be not more than 5% of total design air quantity of systems at 6" H2O.

C. First shipment of low pressure ductwork delivered and erected at the project site shall be tested. Two additional random tests shall be conducted at request of Owner's Representative during remainder of project with test locations as determined by Owner's Representative. Low pressure duct systems shall be tested at 1.5 times the operating pressure.
pressure. Maximum allowable leakage shall be not more than 3% of total design air quantity systems.

END OF SECTION
PART 1 – GENERAL

1.1 SUMMARY

A. Section includes:
   1. Exterior ductwork, designed, manufactured, and pre-insulated for thermal efficiency, low leakage, and weather resistance.
   2. Pressure Class: 6" w.g. positive and 6" w.g. negative.

B. This section does not include:
   1. Air passages rated over a continuous internal static pressure of 6" w.g. positive, 6" w.g. negative, or with test pressure rating over: 10" w.g. startup and 10" w.g. negative (as documented on product labeling).

1.2 SUBMITTALS

A. Product data: For each type of product indicated.

B. Shop drawings: Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work including:
   1. Duct layout indicating sizes and pressure classes.
   2. Elevation of top of ducts.
   3. Dimensions of main duct runs from building grid lines.
   4. Fittings.
   5. Penetrations through fire-rated and other partitions.

C. Coordination Drawings: Plans, drawn to scale, showing coordination general construction, building components, and other building services.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Exterior ductwork can be installed by competent trained field mechanics who demonstrate competence in the HVAC industry.
1.4 SPECIFICATION COMPLIANCE

A. Duct Leakage Class, follow SMACNA Leakage Class 3 or less.

B. Exterior ductwork shall incorporate a Kingspan KoolDuct fortified inner liner compliant to UL (C-UL) 181 Standard for Safety Listed, Class 1 system, with included testing and passing the following:

1. Test for Surface Burning Characteristics
2. Flame Penetration Test
3. Burning Test
4. Mold Growth and Humidity Test
5. Low Temperature Test and High Temperature Test
6. Puncture Test
7. Static Load Test
8. Impact Test
9. Pressure Test and Collapse (negative pressure) Test
10. High Temperature and Humidity for 90 days
11. Cone Calorimeter
12. ASTM E2257 Standard Test Method for Room Fire Test of Wall and Ceiling Materials and Assemblies
13. ASTM E 84 tested, Tunnel Test, Does not exceed 25 flame spread, 50 smoke developed.
14. DW144, Class B
15. NRTL product approval, (Subpart S of 29 CFR Part 1910, OSHA)
16. ASTM C 423 noise reduction
17. ASTM E 96/E 96M Procedure A for permeability
18. ASTM C 1071 for erosion
20. UL 723, Test for Surface Burning Characteristics of Building Materials
21. NFPA Compliance:
   a. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems"
   b. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems"
   c. NFPA 255, "Standard Method of Test of Surface Burning Characteristics of Building Materials

B. Exterior ductwork outer shell shall be a UV stable 1000 micron high impact resistant titanium infused vinyl with included testing as following;

1. UL-94 Flammability V-0
2. ASTM D-638 Tensile Strength of 6250 psi
3. ASTM D-790 Flexible Strength of 11,000 psi
4. ASTM D-4226 Drop Impact Resistance
5. ASTM D-4216 Cell Classification
1.5 PRODUCT DELIVERY AND STORAGE

A. Prevent objectionable aesthetic damage to the outer surface of duct segments during transport and storage.

B. Store duct segments under cover and protect from excessive moisture prior to installation.

PART 2 – PRODUCTS

2.1 EXTERIOR RECTANGULAR DUCT AND FITTINGS

A. Acceptable Manufacturers:
   1. Thermaduct with Kingspan Kooltherm thermoset resin insulated core (Basis of Design)
   2. Approved Equal

B. The panel shall be manufactured of CFC-free closed cell rigid thermoset resin thermally bonded on both sides to a factory applied .001" (25 micron) aluminum foil facing reinforced with a fiberglass scrim. An added UV stable, 1000 micron high impact resistant titanium infused vinyl is factory bonded to the outer surfaces to provide a zero permeability water tight barrier.

C. The thermal conductivity shall be no greater than 0.13 BTU • in/Hr • ft² • °F, the thermal conductivity shall be no greater than 0.13 BTU • in/Hr • ft² • °F.

D. The density of the Kooltherm foam shall not be less than 3.5 PCF with a minimum compressive strength of 28 psi (.2 MPa).

E. The panel thickness, R-value, and other characteristics shall be as follows:
   1. Maximum Temperature: Continuous rating of 185 °F inside ducts or ambient temperature surrounding ducts.
   2. Maximum Thermal Conductivity: 0.13 Btu x in./h x sq. ft. x deg F at 75 °F mean temperature.
   3. Permeability: 0.00 perms maximum when tested according to ASTM E 96/E 96M, Procedure A.
   4. Antimicrobial Agent: Additive for antimicrobial shall not be used but instead, raw product must pass UL bacteria growth testing.
   5. Noise-Reduction Coefficient: 0.05 minimum when tested according to ASTM C 423, Mounting A.
   6. Required Markings: All interior duct liner shall bear UL label and other markings required by UL 181 on each full sheet of duct panel; UL ratings for internal closure materials.
   7. All insulation materials shall be closed cell with a closed cell content of >90%.
   8. R-value: 2 1/16” Thick Panel: 14.1 R

F. Closure Materials:
   1. V-Groove Adhesive: Silicone (interior only).
2. UV stable 39 mil high impact resistant titanium infused vinyl (exterior).
   a. Factory manufactured seamless corners for zero perms.
   b. Cohesive bonded over-lap at corner seam covers for zero perms.
   c. Water resistant titanium infused welded vinyl seams.
   d. Mold and mildew resistant.
3. Polymeric Sealing System:
   a. Structural Membrane: Aluminum scrim with woven glass fiber with UV stable vinyl clad applied
   b. Minimum Seam Cover Width: 2 7/8” inches
   c. Sealant: Low VOC.
   d. Color: White
   e. Water resistant.
   f. Mold and mildew resistant.
4. Duct Connectors.
   a. Factory manufactured cohesive bonded strips (low pressure only).
   b. Factory manufactured all aluminum grip flange.
      1) Grip flange
      2) F-flange
      3) H-flange
      4) U-flange
   c. Factory manufactured galvanized 4-bolt flange.
G. Outdoor Cladding
   1. Duct segments shall incorporate UV stable 39 mil high impact resistant titanium infused vinyl which is introduced during the manufacturing process.
H. Flange coverings
   1. Flanges are field sealed airtight before flange covers are installed. Flange covering consists of the following:
      a. Foam tape insulation with molded 39 mil covers.
      b. Air gap (heating only application) with molded 39 mil covers.
I. Weight
   1. Exterior ductwork shall provide low weight stresses on the building framing and support members. Assembled exterior ductwork shall have a weight of 0.86 lbs. per square foot to maximum weight of 2.7 lbs. per square foot (depending on R-value). Hangers and tie-downs are to be detailed on the manufacturer’s installing contractors detail drawings prior to installation but not exceeding 13’ for duct girth <84” and 8’ for duct girth >85” between hangers and designed to carry the weight and wind load of the ductwork.
J. Interior Surface
   1. Galvanized steel interior liner.

PART 3 – EXECUTION
3.1 SHOP FABRICATION

A. Certification:

1. Ducts shall be detailed and fully factory manufactured by an authorized manufacturer’s facility system. All fabrication labor will be certified “yellow label” building trade professionals, compliant to SMWIA and SMACNA labor guidelines (work preservation observed).

B. Fabrication:

1. Where possible radium type duct elbows shall be used.
2. Fabricated joints, seams, transitions, reinforcement, elbows, branch connections, access doors and panels, and damage repairs according to manufacturer’s written and detailed instructions.
3. Fabricated 90-degree mitered elbows shall include turning vanes.
4. Fabricated duct segments in accordance with manufacturer’s written details.
5. Duct Fittings shall include 6 inches of connecting material, as measured, from last bend line to the end of the duct. Connections on machine manufactured duct may be 4 inches.
6. Fabricated duct segments utilizing v-groove method of fabrication. Factory welded or cohesively bonded seams will apply to fully manufactured ductwork and fittings. Internal seams will be supplied with an unbroken layer of low VOC silicone or bonding (for paint shop applications). Each duct segment will be factory supplied with either aluminum grip pro-file or pre-insulated duct connectors in accordance with manufacturer’s detailed submittal guide. Applied duct reinforcement to protect against side deformation from both positive and negative pressure per manufacturer’s design guide based on specified ductwork size and system pressure.
7. Designed and fabricated duct segments and fittings will be in accordance with “SMACNA Duct Construction Standards” latest edition.
8. Both positive and negative ductwork and fittings shall be constructed to incorporate a UL Listed as a Class 1 air duct to Standard for Safety UL 181 liner with an exterior clad for permanent protection against water intrusion.
9. Duct shall be constructed to exceed requirements for snow and wind loads.

3.2 DUCT INSTALLATION

A. Duct segments shall be installed be competent HVAC installers.

B. Install ducts and fittings to comply with manufacturer’s installation instructions as follows:

1. Install ducts with fewest possible joints.
2. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
3. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
4. Protect duct interiors from the moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."
5. Use prescribed duct support spacing as described in this specification and manufacturer’s recommendations.
6. Air Leakage: Duct air leakage rates to be in compliance with “SMACNA HVAC Duct Construction Standards” latest version per applicable leakage class based on pressure.

3.3 HANGER AND SUPPORT INSTALLATION

A. Contractor to ensure that the ductwork system is properly and adequately supported.

1. Ensure that the chosen method is compatible with the specific ductwork system requirements per manufacturer’s installation detail drawings. Pre-installation should be provided prior to work commencement by installing contractor for approval.
2. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Supports on straight runs of ductwork shall be positioned at centers not exceeding 13 feet for duct sections when fabricated in 13 foot lengths with duct girth less than 84”. Larger duct sizes and short segments with duct girth greater than 84” are to be supported at 8 foot centers or less, in accordance with the manufacturer’s installation details provided prior to work commencement.

C. Ductwork shall be supported at changes of direction, at branch duct connections, tee fittings, parallel under turning vanes and all duct accessories such as dampers, etc.

D. The load of such accessories to the ductwork shall be neutralized by the accessory support.

3.4 FIELD QUALITY CONTROL

A. Inspection: Arrange for manufacturer's representative to inspect completed installation and provide written report that installation complies with manufacturer's written instructions.

1. Remove and replace duct system where inspection indicates that it does not comply with specified requirements.

B. Perform additional testing and inspecting, at the Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

3.5 DUCT SCHEDULE

A. Outdoor Ducts and Fittings:

1. Exterior Rectangular Ducts and Fittings:
   a. Minimum Panel Thickness: 1 ¾ in.
   b. Cladding: minimum 0.038 inch

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Manual volume dampers
   2. Control dampers
   3. Fire dampers
   4. Smoke dampers
   5. Flange connectors
   6. Turning vanes
   7. Duct-mounted access doors
   8. Flexible connectors
   9. Flexible ducts
   10. Duct accessory hardware
   11. Combination fire/smoke dampers

1.2 SUBMITTALS

A. LEED Submittal
   1. Provide data for Prerequisite EQ1: Documentation indicating that units comply with ASHRAE 62.1-2004, Section 5 – "Systems and Equipment".

B. Product Data: For each type of product indicated.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE


B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
B. Galvanized Sheet Steel: Comply with ASTM A 653.
   1. Galvanized Coating Designation: **G90**.
   2. Exposed-Surface Finish: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480, Type 304, and having a No. 2 finish for concealed ducts and for exposed ducts.

D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Air Balance Inc.; a division of Mestek, Inc.
      b. American Warming and Ventilating; a division of Mestek, Inc.
      c. McGill AirFlow LLC.
      d. Pottorff; a division of PCI Industries, Inc.
      e. Ruskin Company.
      f. Titus.
      g. Krueger
      h. Tuttle & Bailey
   2. Standard leakage rating, with linkage outside airstream.
   3. Suitable for horizontal or vertical applications.
   4. Frames
      a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
      b. Mitered and welded corners.
      c. Flanges for attaching to walls and flangeless frames for installing in ducts.
   5. Blades
      a. Multiple or single blade.
      b. Parallel- or opposed-blade design.
      c. Stiffen damper blades for stability.
      d. Galvanized-steel, 0.064 inch thick.
   7. Bearings:
      a. Molded Synthetic or Stainless steel sleeve.
      b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
   8. Tie Bars and Brackets: Galvanized steel.
B. Standard, Aluminum, Manual Volume Dampers

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Air Balance Inc.; a division of Mestek, Inc.
   b. American Warming and Ventilating; a division of Mestek, Inc.
   c. McGill AirFlow LLC.
   d. Pottorff; a division of PCI Industries, Inc.
   e. Ruskin Company.
2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames: Hat-shaped, 0.10-inch thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Roll-Formed Aluminum Blades: 0.10-inch thick aluminum sheet.
   e. Extruded-Aluminum Blades: 0.050-inch thick extruded aluminum.
7. Bearings:
   a. Molded Synthetic or Stainless steel sleeve.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Aluminum.

C. Jackshaft

2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware

2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.3 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Flexmaster U.S.A., Inc.
5. McGill AirFlow LLC.
6. Ruskin Company.
7. Young Regulator Company.

B. Frames

1. Hat shaped.
2. Galvanized-steel channels, 0.064 inch thick.
3. Mitered and welded corners.

C. Blades

1. Multiple blade with maximum blade width of 8 inches.
2. Parallel- and opposed-blade design.
4. 0.064 inch thick.

D. Blade Axles: 1/2-inch-diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

E. Bearings

1. Molded Synthetic or Stainless steel sleeve.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.4 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Arrow United Industries.; a division of Mestek, Inc.
4. McGill AirFlow LLC.
5. Pottorff; a division of PCI Industries, Inc.
6. Prefco; Perfect Air Control, Inc.
7. Ruskin Company.

B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 6-inch wg static pressure class and maximum 4000-fpm velocity.

D. Fire Rating: 1-1/2 hours.
E. Frame: Curtain type with interlocking blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners. Frame for medium/high velocity ductwork shall be welded.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
   1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.
   2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.034-inch-thick, galvanized sheet steel.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.


K. Heat-Responsive Device: Electric resettable link and switch package, factory installed, 165 deg F rated.

L. Closure spring: Stainless steel.

2.5 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Air Balance Inc.; a division of Mestek, Inc.
   2. Greenheck Fan Corporation.
   3. Ruskin Company.

B. General Requirements: Label according to UL 555S by an NRTL.

C. Smoke Detector: Integral, factory wired for single-point connection.

D. Frame: Curtain type with interlocking blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034" thick galvanized steel; with mitered and interlocking corners.

E. Blades: Roll-formed, horizontal, interlocking, 0.034" thick, galvanized sheet steel.

F. Leakage: Class I.

G. Rated pressure and velocity to exceed design airflow conditions.

H. Mounting Sleeve: Factory-installed, 0.052" thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.
I. Damper Motors: two-position action.

J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections.

3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.

4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.

5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.

6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.

7. Electrical Connection: 115 V, single phase, 60 Hz.

K. Accessories

1. Auxiliary switches for signaling.

2.6 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.


3. SEMCO Incorporated.

B. Description: factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gauge and Shape: Match connecting ductwork.

2.7 TURNING VANES

A. Acceptable Manufacturers

B. Turning vanes shall be installed at each change in direction of square or rectangular, low and medium velocity supply air ductwork, particularly at mitered elbows where radius elbows are impractical, and shall be of sizes to suit ductwork.

C. Turning vanes shall be installed in outdoor air intake, return or exhaust ducts only specifically shown or noted on the drawings.

D. Turning vanes shall be an engineered, true airfoil design with smoothly rounded entry nose and extended trailing edge for low-pressure drop, anti-dirt, and positive fastening.

E. Generated sound power level shall not exceed 54 decibels in band 4 at 2,000 FPM-duct 24 x 24.

F. Fabricate assemblies with the Aero-Dyne Side Rail support system. Install vanes on design centers of 2.4 inches across the full diagonal dimension of the elbow. Tabbed or slotted dimple fasteners are not acceptable.

G. Submittals are required; proposed substitution shall include independent performance test data for pressure loss and generated sound power levels.

2.8 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Ductmate Industries, Inc.
3. Greenheck Fan Corporation
4. McGill AirFlow LLC
5. Pottorff; a division of PCI Industries, Inc.
6. Ventfabrics, Inc.


1. Door
   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Vision panel. (where noted on drawings)
   d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
   e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

3. Number of Hinges and Locks
   a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

4. Doors in kitchen exhaust ducts, designed specifically for this service with greasetight gasketing and minimum of 16 gage black steel.

2.9 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Flame Gard, Inc.
3. 3M

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.

D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.10 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Ventfabrics, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch-wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.


1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.
   1. Minimum Weight: 24 oz./sq. yd.
   3. Service Temperature: Minus 50 to plus 250 deg F.

G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
   1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
   2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
   6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
   7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.11 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Flexmaster U.S.A., Inc.
   2. McGill AirFlow LLC

B. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.
   1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
   3. Temperature Range: Minus 10 to plus 160 deg F.

C. Noninsulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire.
   1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
   3. Temperature Range: Minus 20 to plus 175 deg F.

D. Noninsulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire.
   1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
3. Temperature Range: Minus 20 to plus 210 deg F.

E. Noninsulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire.
   1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
   3. Temperature Range: Minus 20 to plus 210 deg F.

F. Noninsulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil.
   1. Pressure Rating: 8-inch wg positive or negative.
   3. Temperature Range: Minus 100 to plus 435 deg F.

G. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.
   1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
   3. Temperature Range: Minus 10 to plus 160 deg F.

H. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.
   1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
   3. Temperature Range: Minus 20 to plus 175 deg F.

I. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.
   1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
   3. Temperature Range: Minus 20 to plus 210 deg F.

J. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.
   1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
   3. Temperature Range: Minus 20 to plus 210 deg F.
K. Insulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.

1. Pressure Rating: 8-inch wg positive or negative.
3. Temperature Range: Minus 20 to plus 250 deg F.

L. Flexible Duct Connectors

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

2.12 COMBINATION FIRE/SMOKE DAMPERS

A. Furnish and install at locations shown on plans, or as described in schedules, combination fire/smoke dampers meeting or exceeding the following specifications. Frame shall be a minimum of 16 gauge galvanized steel formed into a structural hat channel reinforced at corners for added strength. The blades shall be airfoil shaped double skin construction with 14 gauge equivalent thickness. Blade action shall be parallel. Bearings shall be stainless steel sleeve turning in an extruded hole in the frame. (Galvanized bearings shall not be acceptable). Blade edge seals shall be silicone rubber and galvanized steel mechanically locked into blade edge (adhesive or clip fastened seals not acceptable) and shall withstand a minimum of 450 degrees F. Jamb seals shall be non-corrosive stainless steel flexible compression type to further ensure smoke management.

B. Each combination fire/smoke damper shall be classified for use for fire resistance ratings of less than 3 hours, in accordance with UL standard 555, and shall further be classified by Underwriters Laboratories as a Leakage Rated Damper for use in smoke control systems in accordance with the latest version of UL555S, and bear a UL label attesting to the same. Damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes, covering all dampers, required by this specification. Testing and UL qualifying a single damper size is not acceptable. The leakage rating under UL555S shall be leakage Class 1 (4 cfm/sq. ft. at 1" wg and 8 cfm/sq. ft. at 4" wg)

C. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (to open and close) and modulate under HVAC system operating conditions, with pressures of at least 4" wg in the closed position, and up to 4,000 fpm air velocity in the open position.

D. In addition to the leakage ratings already specified herein, the dampers and their actuators shall be qualified under UL555S to an elevated temperature of 350 degrees F or 450 degrees F depending upon the actuator. Appropriate 120 volt electric two position actuators shall be installed by the damper manufacturer at time of damper fabrication. Damper and actuator shall be supplied as a single entity, which meets all applicable UL55 and UL555S qualifications for both dampers and actuators. Manufacturer shall provide factory assembled sleeve of 17" minimum length (contractor to verify requirement). Factory supplied caulked sleeve shall be 20 gauge for dampers through 84" wide and 18 gauge above 84" wide. Damper and actuator assembly shall be factory cycled 10 times to assure operation.
E. Each combination fire/smoke damper shall be equipped with a controlled 7 to 15 second heat-actuated release device. The electric EFL shall close and lock the fire/smoke damper during test, smoke detection, power failure or fire conditions through actuator, closure springs. To prevent duct and HVAC component damage, the damper shall at all times be connected to the actuator for controlled closure in not less than 7 seconds and no more than 15 seconds. Instantaneous damper closure is unacceptable. Damper shall be automatic remote resettable after test, smoke detection of power failure conditions. After exposure to high temperature or fire, the damper must be inspected prior to reset to ensure proper operation. Release temperatures are 165 degrees F.

F. TS150 FireStat: Each combination fire/smoke damper shall be equipped with a UL Classified FireStat equal to Ruskin model TS150. FireStat shall electrically and mechanically lock damper in a closed position when duct temperature exceeds 165 degrees F and still allow appropriate authority to override FireStat and operate damper as may be required for smoke management functions. Damper must be operable while temperature is above 350 degrees F. FireStat package shall include two damper position indicator switches linked directly to damper blade to provide capability of remotely indicating damper position. One switch shall close when damper is fully open; the other switch shall close when damper is fully closed. FireStat and position indicator switches shall be capable of interfacing electrically with smoke detectors, building fire alarm systems, and remote indicating/control stations. FireStat shall be equipped with High Limit Temperature Sensor that meets all requirement of NFPA92A by returning damper to fire protection mode when temperatures reach 350 degrees F, which is the operational limit of the damper and actuator assembly. Dampers shall be Ruskin Model FSD60 with TS150 FireStat package.

G. SP100 Blade Position Indicator (included as part of TS150 FireStat or supplied separately): Each damper shall be equipped with Ruskin SP100 Switch Package or equivalent. The Switch Package shall include two position indicator switches linked directly to the damper to remotely indicate damper blade position.

H. PFMA: 1-1/2" or 2-1/2" two piece picture frame mounting angles shall be factory supplied and shipped on each damper (requires factory sleeve).

2.13 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.14 SHRINK WRAP

A. For duct protection during construction, provide shrink wrap duct openings with pressure sensitive adhesive. Shall be as manufactured by Elgen Manufacturing or approved equal.
B. Three (3) mil thickness with water based adhesive that does not leave any residue when removed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at outlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Install volume dampers in each branch duct serving a diffuser or register (supply, return, and exhaust).

F. Set dampers to fully open position before testing, adjusting, and balancing.

G. Install test holes at fan inlets and outlets and elsewhere as indicated.

H. Install fire dampers, smoke dampers, and combination fire smoke dampers according to UL listing.

I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream and downstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors; and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot spacing.
8. Upstream from turning vanes.
9. Control devices requiring inspection.
10. Elsewhere as indicated.

J. Install access doors with swing against duct static pressure.

K. Access Door Sizes

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.

L. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

M. Install flexible connectors to connect ducts to equipment.

N. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

O. Connect terminal units to supply ducts with maximum 48-inch lengths of flexible duct. Do not use flexible ducts to change directions.

P. Connect diffusers or light troffer boots to ducts directly or with maximum 24-inch lengths of flexible duct clamped or strapped in place.

Q. Connect flexible ducts to metal ducts with liquid adhesive plus tape.

R. Install duct test holes where required for testing and balancing purposes.

S. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

T. Provide turning vanes in non-radius elbows.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Adjustable bar registers and grilles
   2. Fixed face registers and grilles

B. Related Sections

1. Division 08 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
   2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 CEILING LINEAR SLOT OUTLETS

2.2 REGISTERS AND GRILLES

A. Adjustable Bar Register (Sidewall-Supply)

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anemostat Products; a Mestek company, Model Rotacore
   b. Krueger
   c. Price Industries
   d. Titus
   e. Tuttle and Bailey

3. Finish: Baked enamel, color selected by Architect
4. Face Blade Arrangement: Horizontal
5. Core Construction: Removable
6. Rear-Blade Arrangement: Vertical
7. Damper Type: Adjustable opposed blade
8. Mitred corners on frame

B. Fixed Face Register (Ceiling Type for Return)

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Anemostat Products; a Mestek company, Models AC3LOD and X3HOD
   b. Krueger
   c. Price Industries
   d. Titus
   e. Tuttle & Bailey
2. Material: Steel
3. Finish: Baked enamel, color selected by Architect
4. Blade angle: 45°
5. Blade spacing: 3/4"
6. Damper Type: Adjustable opposed blade

C. RETURN GRILLES

1. Manufacturers; Subject to compliance with requirements, provide products by one of the following:
   a. Tuttle and Bailey Model T110
   b. Krueger
   c. Pace Industries
   d. Titus
   e. Anemostat
2. Aluminum construction with countersunk screws and lattice type face. Provide core with a free area of not less than 90%. Furnish frame with sponge rubber gasket.
3. Core construction shall be such that openings cannot pass a 1/2" diameter sphere. Provide baked enamel finish, color selected by Architect.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."
3.1 INSTALLATION

A. Install diffusers, registers, and grilles level, plumb and in accordance with manufacturer's instructions.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

D. All air distribution devices shall be diffusers or registers. Use grilles only where noted or where air flow rate is not shown.

E. Where diffusers are connected to ductwork or air valves with flexible duct, the diffuser shall be mounted to ceiling construction.

F. Baffle diffusers in field to achieve proper air distribution in accordance with diffuser location.

G. Verify type of ceiling construction prior to submittal.

H. Install all registers and diffusers after painting is completed.

I. All registers and grilles located in walls shall be color as selected by Architect.

J. Relief, return and exhaust registers located in lay-in ceilings shall be Model AC3LOD Anemostat (or as approved). Where located in non-lay-in ceilings, provide Model X3HOD Anemostat (or as approved). Where located in walls, provide Anemostat Model ROTACORE or as approved.

K. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement. Do not exceed 0.08" H₂O static pressure drop for registers and diffusers. Do not exceed 0.05" H₂O static pressure drop for grilles.

L. Sound criteria shall not exceed NC-30.

M. Paint ductwork visible behind air outlets and inlets matte black. Painting by Heating Contractor.

N. All diffusers located in Gymnasium, Auditorium, and other areas 12 feet above floor shall be provided with safety chains to prevent falling on occupants.
O. Provide balancing dampers in duct take-off to each diffuser, register and grille regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

3.2 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION
SECTION 23 74 13 - PACKAGED AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes packaged, outdoor, air-handling units (rooftop units) with the following components and accessories:

1. Direct-expansion cooling
2. Hot gas reheat coil
3. Supply and exhaust fans
4. Hot water heating coils
5. Energy Wheel
6. Integral, space temperature controls
7. Roof curbs

1.2 DEFINITIONS

A. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

B. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

C. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

D. Supply-Air Fan: The fan providing supply-air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

E. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

1.3 SUBMITTALS

A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.


C. Field quality-control test reports.

D. Operation and maintenance data.

E. Warranty.

1.4 QUALITY ASSURANCE

A. ARI Compliance

1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
2. Comply with ARI 270 for testing and rating sound performance for RTUs.

B. ASHRAE Compliance

1. Comply with ASHRAE 15 for refrigerant system safety.
2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
3. Comply with applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."


D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

E. UL Compliance: Comply with UL 1995.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.
3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
4. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1. MANUFACTURERS
A. Available Manufacturers: Subject to compliance with specifications contained within this document, manufacturers offering products that may be incorporated into the work include, but are not limited to:
   1. Mitsubishi Electric US, Inc.
   2. LG
   3. Aaon
   4. Greenheck

2.2. MANUFACTURED UNITS
A. Unit shall be fully assembled at the factory and consist of an insulated metal cabinet, exhaust air blower, evaporator coil, energy wheel, hot water coil, hot gas reheat coil, packaged DX system, phase and brownout protection, motorized dampers, motorized recirculating damper, curb assembly, filter assembly intake air, supply air blower assembly, exhaust/relief blower assembly, filter assembly for exhaust air, and an electrical control center. All specified components and internal accessories factory installed are tested and prepared for single-point high voltage connection except with electric post heat which has dual point power.

2.3. CABINET
A. Materials: Formed, double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.
   1. Outside casing: 22 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish. Pre-painted components as supplied by the factory shall have polyester urethane paint on 22 gauge G60 galvaneal steel. Unit’s exterior shall be supplied from the manufacturer using G60 galvaneal steel with proprietary pre-painted material in the following finish color; Concrete Gray-RAL 7023. This has been subjected to a salt spray test per ASTM-B117 and evaluated using ASTM-D714 and ASTM-D610 showing no observable signs of rust or blistering until reaching 2,500 hours.
   2. Internal assemblies: 22 gauge, galvanized (G90) steel except for motor supports which shall be minimum 14 gauge galvanized (G90) steel.

B. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.
   1. Materials: Rigid urethane foam
      a. Thickness: 2 inch (50 mm)
      b. Meets UL94HF-1 flame requirements.
      c. Location and application: Full coverage of entire cabinet exterior to include walls, roof of unit, unit base, and doors.
C. Access panels / doors: Unit shall be equipped with insulated, hinged doors or removable access panels to provide easy access to all major components. Doors and access panels shall be fabricated of 22 gauge galvanized G90 steel or painted galvannealed steel.

D. Supply Air blower assemblies: Blower assembly shall consist of an electric motor and direct-drive fans. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motors shall be capable of continuous speed modulation and controlled by a VFD.

E. Exhaust Air blower assemblies: Blower assembly shall consist of an electric motor and a direct-drive fan. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motor shall be capable of continuous speed modulation and controlled by a VFD.

F. Evaporator Coil: Evaporator coil shall be AHRI Certified and shall be (silver) soldered or brazed into the compressed refrigerant system. Coil shall be constructed of copper tubing, permanently bonded to aluminum fins and enclosed in a galvanized steel frame. If two compressors are used as components of the unit, then the evaporator coil shall be of "interlaced" configuration, permitting independent operation of either compressor without conflict with the other compressor.

G. Control panel / connections: Units shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections. RTU shall be equipped with a Unit Disconnect Switch.

H. Condensate drain pan: Drain Pan shall be an integral part of the unit whenever a cooling option is included. Pan shall be formed of welded austenitic stainless steel sheet material and provided with a welded stainless steel drain connection at the front for connection to a P trap. Drain pan shall be sloped in two directions to provide positive draining and drain connector shall be sealed at penetration through cabinet wall.

I. P trap: If the unit is equipped with a condensate drain pan, contractor shall provide, or fabricate, and install an appropriate P trap, in accordance with all local and area codes and Best Practices.

J. Energy wheel: Energy wheel shall be of total enthalpy, rotary air-to-air type and shall be an element of a removable energy wheel cassette. The cassette shall consist of a galvanized steel framework (designed to produce laminar air flow through the wheel), an energy wheel as specified and a motor and drive assembly. The cassette shall incorporate a pre-tensioned urethane drive belt with a five year warranty. The wheel media shall be a polymer film matrix in a stainless steel framework and be comprised of individual segments that are removable for servicing. Non-segmented energy wheels are not acceptable. Silica gel desiccant shall be permanently bonded to the polymer film and is designed and constructed to permit cleaning and servicing. The energy wheel is to have a five year warranty. Performance criteria are to be as specified in AHRI Standard 1060, complying with the Combined Efficiency data in the submittal.

K. Modulating frost control. Control system shall include an outdoor air thermostat and pressure sensor on the wheel assembly to initiate frost control sequence.
L. Hot water coil shall be factory installed and meet the design requirements as above.

M. Reheat coil with factory installed modulating hot gas reheat valve.

N. Packaged DX System: Unit shall have an integral compressor(s) and evaporator coil located within the weather-tight unit housing. Condenser coils and appurtenant condenser fan assemblies shall be factory installed as integral subassemblies of the unit and mounted on the exterior of the unit. Condenser fan shall have an external rotor motor with swept fan blades for low sound operation. Motors shall be UL Recognized and CSA Certified. The refrigerant compressor(s) shall be digital hermetic scroll-type and shall be equipped with liquid line filter drier, thermostatic expansion valves (TXV)(s), manual reset high pressure and low pressure cutouts and all appurtenant sensors, service ports and safety devices. Compressed refrigerant system shall be fully charged with R-410A refrigerant. Each compressor shall be factory-equipped with an electric crankcase heater to boil off liquid refrigerant from the oil.

O. Packaged DX Control and Diagnostics: The Packaged DX system shall be controlled by an onboard digital controller (DDC) that indicates both owner-supplied settings and fault conditions that may occur. The DDC shall be programmed to indicate the following faults:

1. Global alarm condition (active when there is at least one alarm)
2. Supply Air Proving alarm
3. Dirty Filter Alarm
4. Compressor Trip alarm
5. Compressor Locked Out alarm
6. Supply Air Temperature Low Limit alarm
   a. Sensor #1 Out of Range (outside air temperature)
   b. Sensor #2 Out of Range (supply air temperature)
   c. Sensor #3 Out of Range (cold coil leaving air temperature)

P. Phase and brownout protection: Unit shall have a factory-installed phase monitor to detect electric supply phase loss and voltage brown-out conditions. Upon detection of a fault, the monitor shall disconnect supply voltage to all motors.

Q. Motorized dampers / Intake Air, Exhaust Air, Motorized dampers of low leakage type shall be factory installed.

R. Curb Assembly: A curb assembly made of 14 gauge galvanized steel shall be provided by the factory for assembly and installation as part of this division. The curb assembly shall provide perimeter support of the entire unit and shall have duct adapter(s) for supply air and return air. Curb assembly shall enclose the underside of the unit and shall be sized to fit into a recess in the bottom of the unit. Contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration. Contractor shall provide and install appropriate insulation for the curb assembly. The curb shall be the height of 14 in..

2.4. BLOWER
A. Blower section construction, Supply Air: direct drive motors and blowers shall be assembled on a 14 gauge galvanized steel platform and shall be equipped with 1.125 inch thick neoprene vibration isolation devices.

B. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.

C. Fan: Direct drive, airfoil plenum fan with steel wheels statically and dynamically balanced and AMCA certified for air and sound performance.

D. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating".

2.5. MOTORS

A. General: Blower motors greater than 3/4 horsepower shall be "NEMA Premium" unless otherwise indicated. Compliance with EPAct minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure.

B. Motors shall be 60 cycle, 3 phase 460 volts.

2.6. UNIT CONTROLS

A. The unit shall be constructed so that it can function as a stand-alone heating and cooling system controlled by factory-supplied controllers, thermostats and sensors or it can be operated as a heating and cooling system controlled by a Building Management System (BMS). This unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various optional sensors.

B. Unit shall incorporate a DDC controller with integral LCD screen that provides text readouts of status. DDC controller shall have a built-in keypad to permit operator to access read-out screens without the use of ancillary equipment, devices or software. DDC controllers that require the use of equipment or software that is not factory-installed in the unit are not acceptable. Alarm readouts consisting of flashing light codes are not acceptable. Owner-specified ventilating conditions can be input by means of pushbuttons.

C. Unit supply fan shall be configured for Constant Volume (ON/OFF).

D. Unit exhaust fan shall be configured for Constant Volume (ON/OFF).

E. Outside Air / Return Air damper control shall be field adjustable two-position.

F. Variable Frequency Drive (VFD): unit shall have factory installed variable frequency drive for modulation of the supply and exhaust air blower assemblies. The VFD shall be factory-programmed for unit-specific requirements and shall not require additional field programming to operate.

2.7. FILTERS

A. Unit shall have permanent metal filters located in the outdoor air intake and shall be accessible from the exterior of the unit. MERV 8 disposable pleated filters shall be provided in the
supply air stream. MERV 8 disposable pleated filters shall be provided in the supply final air stream and MERV 8 filters in the exhaust air stream.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment Mounting: Install RTUs on concrete base using restrained spring isolators. Comply with requirements for concrete base specified in Division 03.
   1. Minimum Deflection: 1 inch.

B. Roof Curb: Install on roof structure, level and secure, according to ARI Guideline B. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Division 07 Section "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.

C. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.

D. Install wind restraints according to manufacturer's written instructions. Wind vibration isolation roof-curb rails are specified in Division 23 Section "Vibration Controls for HVAC Piping and Equipment."

E. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.

F. Install piping adjacent to RTUs to allow service and maintenance.

G. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
   1. Install ducts to termination at top of roof curb.
   2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
   3. Connect supply ducts to RTUs with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."
   4. Install return-air duct continuously through roof structure.
   5. Install normal-weight, 3000-psi, compressive strength (28-day) concrete mix inside roof curb, 4 inches thick. Concrete, formwork, and reinforcement are specified in Division 03.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.

C. Tests and Inspections

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

3.3 CLEANING AND ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.

B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

END OF SECTION
SECTION 23 81 27 – DUCTLESS SPLIT-TYPE AIR-CONDITIONING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting.

1.2 SUBMITTALS

A. Product Data: For each unit indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."


1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace split-system air-conditioning units that fail in materials and workmanship within five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Mitsubishi Electronics America, Inc.; HVAC Division
   2. LG
B. Ductless Split System Heat Pump Unit (Multi Zone “M” series):

1. System Description
   a. The heat pump air conditioning system shall be a variable capacity multi-zone series. The system shall consist of indoor fan coil sections with digital wired remote controller connected to a compact horizontal discharge outdoor unit which shall be of an inverter driven heat pump design.

2. Outdoor Units
   a. General
      1) The outdoor unit must have a fused powder coated finish. The outdoor unit shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory prior to shipment.

   b. Unit Cabinet:
      1) All casing and cabinet components shall be fabricated of galvanized steel, bonderized finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for durable, corrosion resistant surface protection.

   c. Fan:
      1) The unit shall be furnished with a direct drive, high performance propeller type fan.
      2) The condenser fan motor shall be a variable speed, direct current (DC) motor and shall have permanently lubricated bearings.
      3) Fan speed shall be switched automatically according to the number of operating indoor units and the compressor operating frequency.
      4) The fan motor shall be mounted with vibration isolation for quiet operation.
      5) The fan shall be provided with a raised guard to prevent contact with moving parts.
      6) The outdoor unit shall have horizontal discharge airflow.

   d. Coil:
      1) The outdoor unit coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
      2) The coil shall be protected with an integral guard.
      3) Refrigerant flow from the outdoor unit shall be independently controlled by means of individual electronic linear expansion valves for each indoor unit.

   e. Compressor:
      1) The compressor motor shall be direct current (DC) type designed for variable speed operation.
      2) The compressor shall be a high performance, hermetic, inverter driven, variable speed, rotary type.
3) The outdoor unit shall be equipped with a suction side refrigerant accumulator.
4) The compressor will be equipped with an internal thermal overload.
5) The compressor shall be mounted to avoid the transmission of vibration.

f. Manifold:
1) The outdoor unit shall have manifold connections providing a separate set of flared fittings for each indoor unit.

g. Electrical:
1) The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2) The unit shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts.
3) The outdoor unit shall be controlled by the microprocessors located in the indoor unit and in the outdoor unit communicating system status, operation, and instructions digitally over A-Control wiring.
4) The outdoor unit shall be equipped with Pulse Amplitude Modulation (PAM) compressor inverter drive control for maximum efficiency with minimum power consumption.

3. Ceiling Cassette Indoor Units:

a. The indoor unit shall be a space-saving ceiling-recessed cassette type, factory assembled, wired and tested. Contained within the unit shall be all factory wiring and internal piping, drain left mechanism, control circuit board, fan, and fan motor. The unit, in conjunction with the remote controller, shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be purged with dry nitrogen before shipment from the factory.

b. Unit Cabinet: The cabinet shall be formed from galvanized sheet metal coated with high-density foam insulation. Cabinet shall be for recessed mounting and provided with four (4) corner mounting supports behind removable corner pockets in Grille assembly allowing adjustment of mounting height from front of unit.
1) The cabinet panel shall have provisions for a field installed filtered outside air intake.
2) There shall be a knock-out to provide a branch air duct for conditioning a secondary space.
3) There shall be an optional multi-function casement which will mount between the unit cabinet and the Grille assembly to provide a second field installed filtered outside air intake and provide a mount for a high-efficiency filter element.
4) A separate grill assembly shall be attached to the front of the cabinet to provide supply air vanes in four directions and a center mounted return air section. The four-way grill shall be fixed to bottom of cabinet allowing two, three or four-way blow. The grill vane angles shall be individually adjustable from the wired remote controller to customize the airflow pattern for the conditioned space. Grill assembly color shall be white.

c. Fan: The indoor fan shall be an assembly with a turbo fan propeller, direct driven by a single motor and shall be statically and dynamically balanced to run on a
motor with permanently lubricated bearings. The indoor fan shall consist of four (4) speed settings, Low, Mid1, Mid2, High and Auto. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and space temperature.

d. Vane: The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow with switches that can be set to provide optimum airflow based on ceiling height and number of outlets used. The indoor unit vanes shall have 5 fixed positions and a swing feature that shall be capable of automatically swinging the vanes up and down for uniform air distribution. The vanes shall have an Auto-Wave selectable option in the heating mode that shall randomly cycle the vanes up and down to evenly heat the space. If specified, the grill shall have an optional i-see® sensor kit installed – sensor function described in System Control Section.

e. Filter: Return air shall be filtered by means of an easily removable, long life, washable filter.

f. Coil: The indoor unit coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange.

1) The heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow. All tube joints shall be brazed with PhosCopper or silver alloy. The coils shall be pressure tested at the factory.

2) A condensate pan with drain connections shall be provided under the coil. The unit shall also include a built-in, automatic condensate lift mechanism that will be able to raise drain water 33 inches (84 cm) above the condensate pan. The lift mechanism shall be equipped with a positive acting liquid level sensor to shut down the indoor unit if liquid level in the drain pan reached maximum level. An optional secondary drain pan level switch (DPLS1), designed to connect to the control board, shall also be provided if required, and installed on the condensate pan.

3) Both refrigerant lines between the indoor unit and outdoor unit shall be fully insulated.

g. Electrical

1) The electrical power of the unit shall be 208 / 230 volts, 1-phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts.

2) The indoor unit shall be provided with A-Control – a system allowing the indoor unit to be powered and controlled directly from the outdoor unit using a fourteen (14) gauge (AWG) 3-wire connection plus ground wire providing both primary power and integrated, by-directional, digital control signal without additional connections.

3) The indoor units shall not have any supplemental or “back-up” electrical heating elements.

h. System Control: The control system shall consist of a minimum of two (2) microprocessors, one on each indoor and outdoor unit, interconnected by a single non-polar two-wire cable. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature,
receiving and processing commands from a wireless or wired controller, providing emergency operation and controlling the outdoor unit. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC. Indoor units shall have the ability to control supplemental heat via connector CN24 and a 12 VDC output.

1) For A-Control, a three (3) conductor 14 gauge AWG wire with ground shall provide power feed and bi-directional control transmission between the outdoor and indoor units. If code requires a disconnect mounted near the indoor unit, a TAZ-MS303 3-Pole Disconnect shall be used – all three conductors must be interrupted.

2) The system shall be capable of automatic restart when power is restored after power interruption. The system shall have self-diagnostics ability, including total hours of compressor run time. Diagnostics codes for indoor and outdoor units shall be displayed on the wired controller panel.

3) Remote Controllers

All remote controllers need to be ordered separately from the unit.

a) Wireless, wall mounted remote controller kit (MHK1) shall consist of a wireless, wall mounted controller (MRCH1), a wireless receiver and a cable to connect the receiver to the indoor unit. The controller shall be white in color with a light-green LCD display and a backlight feature. The MRCH1 shall consist of four Function buttons below the display, and Increase/Decrease Set Temperature buttons and a Hold button to the right of the display. The controller shall have a built-in temperature sensor and a battery holder, using two AA alkaline batteries. Temperature shall be displayed in either Fahrenheit (°F) or Celsius (°C), and temperature changes shall be by increments of 1°F (0.5°C). The MHK1 uses Honeywell RedLINKTM technology, and the wireless receiver is specially designed for Mitsubishi units. Linking to the wireless network shall be done from the receiver and from the remote controller. There shall not be any interference with other wireless devices or neighboring RedLINKTM products. Communication shall be automatically restored after power resumes and after batteries are replaced. Two optional devices can be used with the MHK1 controller kit. These are, an outdoor air sensor, which allows the display of the outdoor temperature and humidity, and a portable central controller, which can control up to 16 zones with On/Off, set temperature, heat/cool mode selection and auto-off timer.

b) Wired Remote Controller (PAR-21MAA) shall be approximately 5” x 5” in size and white in color with a light-green LCD display. The PAR-21MAA shall support a selection from multiple languages (Spanish, German, Japanese, Chinese, English, Russian, Italian, or French) for display information. There shall be a built-in weekly timer with up to 8 pattern settings per day. The controller shall consist of an On/Off button, Increase/Decrease Set Temperature buttons, a Cool/Auto/Fan/Dry mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Ventilation button, a Test Run button, and a Check Mode button. The controller shall have a built-in temperature sensor. Temperature shall be...
displayed in either Fahrenheit (°F) or Celsius (°C), and Temperature changes shall be by increments of 1°F (0.5°C). The PAR-21MAA shall have the capability of controlling up to a maximum of 16 systems, as a group with the same mode and set-point for all, at a maximum developed control cable distance of 1,500 feet (500 meters). The control voltage from the wired controller to the indoor unit shall be 12/24 volts, DC. Field wiring shall run directly from the indoor unit to the wall mounted controller with no splices. Up to two wired controllers shall be able to be used to control one unit.

c) Wireless Remote Controller Kit (PAR-FL32MA). The wireless handheld remote controller shall be used with a wireless receiver (PAR-SA9FA-E). The controller shall perform input functions necessary to operate the system. The wireless receiver shall be plug and fit compatible with the indoor unit. The controller shall have a Power On/Off switch, Mode Selector – Cool, Dry, Heat, Auto, and Powerful Modes - Temperature Setting, Timer Control, Fan Speed Select and Horizontal and Vertical Vane control selector. There shall be an i-See® Sensor Area Selector control. The indoor unit shall perform Self-diagnostic Function and Check Mode switching. Temperature changes shall be in 1°F (0.5°C) increments with a setting range of 61 to 88°F (16 to 31°C).

4) The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the wireless or a wired controller, providing emergency operation and controlling the outdoor unit.

5) Indoor units shall be equipped with an optional “i-see® Sensor” kit, providing i-See® Sensor technology providing uniform temperature detection and automatically response to adjust the set temperature to provide uniform comfort from floor to ceiling.

4. Control:

a. The unit shall have a wired controller to perform input functions necessary to operate the system.

b. The wired controller shall have a Power On/Off switch, Mode Selector – Cool, Dry, Heat, Auto Modes - Temperature Setting, Timer Control, Fan Speed Select and Auto Vane selector.

c. The indoor unit shall perform Self-diagnostic Function and Check Mode switching.

d. Temperature changes shall be by 1°F increments with a range of 59 - 89°F.

e. The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the wireless or a wired controller, providing emergency operation and controlling the outdoor unit.

f. The system shall be capable of automatically restarting and operating at the previously selected conditions when the power is restored after power interruption.

g. Control system shall control the continued operation of the air sweep louvers, as well as provide On/Off, System/Mode function.
h. Indoor Thermostat – Wired controller shall be a PAR-21MAA Deluxe MA type remote controller. Hard-wired, wall mounted remote controller shall require a MAC-397IF-E MA Series Terminal Interface for communications. Interface will be mounted at the indoor unit.

2.2 ACCESSORIES

A. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

B. Install ground-mounted, compressor-condenser components on 4-inch thick, reinforced concrete base; 4 inches larger on each side than unit. Coordinate anchor installation with concrete base.

C. Install ground-mounted, compressor-condenser components on polyethylene mounting base.

D. Install roof-mounted, compressor-condenser components on equipment supports. Anchor units to supports with removable, cadmium-plated fasteners.

E. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch. Refer to Division 23 Section "[Vibration] Controls for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Connect with shutoff-duty valves.

B. Install piping adjacent to unit to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections. Report results in writing.

B. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new components, and retest.
D. Test operate systems, and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Test for leaks and make repairs.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

B. See Division 23 Section "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.

1.2 SUBMITTALS

A. Product Data: For each control device indicated.

B. Shop Drawings

1. Schematic flow diagrams.
2. Power, signal, and control wiring diagrams.
3. Details of control panel faces.
4. Damper schedule.
5. Valve schedule.
6. DDC System Hardware: Wiring diagrams, schematic floor plans, and schematic control diagrams.
7. Control System Software: Schematic diagrams, written descriptions, and points list.

C. Software and firmware operational documentation.

D. Field quality-control test reports.

E. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
2.2 CONTROL SYSTEM

A. Manufacturers
   1. Schneider Electric

B. Installers
   Control Systems Inc.
   Hagerstown, MD 21701

C. Control system shall be web based with full access via the world-wide web.

D. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.

E. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

2.3 DDC EQUIPMENT

A. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
   1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation.
   2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
      a. Global communications.
      b. Discrete/digital, analog, and pulse I/O.
      c. Monitoring, controlling, or addressing data points.
      d. Software applications, scheduling, and alarm processing.
      e. Testing and developing control algorithms without disrupting field hardware and controlled environment.

B. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
   1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
   2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
      a. Global communications.
      b. Discrete/digital, analog, and pulse I/O.
      c. Monitoring, controlling, or addressing data points.
   3. Local operator interface provides for download from or upload to operator workstation.
C. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.

1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
7. Universal I/Os: Provide software selectable binary or analog outputs.

D. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:

1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

E. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:

1. Minimum dielectric strength of 1000 V.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.4 UNITARY CONTROLLERS

A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.

1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. [Perform scheduling with real-time clock.] Perform automatic system diagnostics; monitor system and report failures.
3. Enclosure: Dustproof rated for operation at 32 to 120 deg F.
2.5 ANALOG CONTROLLERS

A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.

B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F, and single- or double-pole contacts.

C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.

1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.

D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.

2.6 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. Thermistor Temperature Sensors and Transmitters

1. Manufacturers
   a. Ebtron, Inc.
   b. Heat-Timer Corporation
   c. MAMAC Systems, Inc.
   d. RDF Corporation

2. Accuracy: Plus or minus \[0.5 \text{ deg F}] \[0.36 \text{ deg F}] at calibration point.


4. Insertion Elements in Ducts: Single point, \[8 \text{ inches}] \[18 \text{ inches}] long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.

5. Averaging Elements in Ducts: \[36 \text{ inches long, flexible}] \[72 \text{ inches long, flexible}]; use where prone to temperature stratification or where ducts are larger than 10 sq. ft.

6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.

7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
   a. Set-Point Adjustment: [Concealed] [Exposed].
   b. Set-Point Indication: [Concealed] [Keyed] [Exposed].
   c. Thermometer: [Concealed] [Exposed].

8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.


C. RTDs and Transmitters
1. Manufacturers
   a. MAMAC Systems, Inc.
   b. RDF Corporation
2. Accuracy: Plus or minus 0.2 percent at calibration point.
4. Insertion Elements in Ducts: Single point, [8 inches] [18 inches] long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
5. Averaging Elements in Ducts: [18 inches long, rigid] [24 inches long, rigid] [48 inches long, rigid] [24 feet long, flexible]; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
6. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
   a. Set-Point Adjustment: [ Concealed ] [ Exposed ].
   b. Set-Point Indication: [ Concealed ] [ Keyed ] [ Exposed ].
   c. Thermometer: [ Concealed ] [ Exposed ].
8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

D. Humidity Sensors: Bulk polymer sensor element.

1. Manufacturers
   a. MAMAC Systems, Inc.
   b. ROTRONIC Instrument Corp.
   c. TCS/Basys Controls
3. Room Sensor Range: 20 to 80 percent relative humidity.
4. Room Sensor Cover Construction: Manufacturer's standard locking covers.
   a. Set-Point Adjustment: [ Concealed ] [ Exposed ].
   b. Set-Point Indication: [ Concealed ] [ Keyed ] [ Exposed ].
   c. Thermometer: [ Concealed ] [ Exposed ].
5. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
6. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of [32 to 120 deg F] [minus 22 to plus 185 deg F] [minus 40 to plus 170 deg F].
7. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.

E. Pressure Transmitters/Transducers

1. Manufacturers
   a. MAMAC Systems, Inc.
   b. ROTRONIC Instrument Corp.
   c. TCS/Basys Controls
2. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
   a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
   b. Output: 4 to 20 mA.
   c. Building Static-Pressure Range: 0- to 0.25-inch wg.
   d. Duct Static-Pressure Range: 0- to 5-inch wg.
3. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.

4. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.

5. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.

6. Pressure Transmitters: Direct acting for gas or liquid service; range suitable for system; linear output 4 to 20 mA.

F. Room Sensor Cover Construction: Manufacturer's standard locking covers.

1. Set-Point Adjustment: [Concealed] [Exposed].
2. Set-Point Indication: [Concealed] [Keyed] [Exposed].
3. Thermometer: [Concealed] [Exposed].

G. Room sensor accessories include the following:

1. Insulating Bases: For sensors located on exterior walls.
2. Guards: [Locking; heavy-duty, transparent plastic; mounted on separate base] [Metal wire, tamperproof] [Locking, solid metal, ventilated].
3. Adjusting Key: As required for calibration and cover screws.

2.7 STATUS SENSORS

A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg.

B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig, piped across pump.

C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

D. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.

E. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.

F. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.

G. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

H. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.
1. Manufacturers
   a. BEC Controls Corporation
   b. I.T.M. Instruments Inc.

2.8 THERMOSTATS

A. Manufacturers
   1. Erie Controls
   3. Heat-Timer Corporation

B. Electric, solid-state, microcomputer-based room thermostat with remote sensor.
   1. Automatic switching from heating to cooling.
   2. Preferential rate control to minimize overshoot and deviation from set point.
   3. Set up for four separate temperatures per day.
   4. Instant override of set point for continuous or timed period from 1 hour to 31 days.
   5. Short-cycle protection.
   6. Programming based on [weekday, Saturday, and Sunday] [every day of week].
   7. Selection features include degree F display, 12- or 24-hour clock, keyboard disable, remote sensor, and fan on-auto.
   8. Battery replacement without program loss.
   9. Thermostat display features include the following:
      a. Time of day
      b. Actual room temperature
      c. Programmed temperature
      d. Programmed time
      e. Duration of timed override
      f. Day of week
      g. System mode indications include "heating," "off," "fan auto," and "fan on"

C. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.

D. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.
   1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.

E. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.
   1. Bulbs in water lines with separate wells of same material as bulb.
   2. Bulbs in air ducts with flanges and shields.
   3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.
4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
5. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.
6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.

F. Fire-Protection Thermostats: Listed and labeled by an NRTL acceptable to authorities having jurisdiction; with fixed or adjustable settings to operate at not less than 75 deg F above normal maximum operating temperature, and the following:
   2. Reset: Automatic, with control circuit arranged to require manual reset at central control panel; with pilot light and reset switch on panel labeled to indicate operation.

G. Room Thermostat Cover Construction: Manufacturer's standard locking covers.
   1. Set-Point Adjustment: [Concealed] [Exposed].
   2. Set-Point Indication: [Concealed] [Keyed] [Exposed].
   3. Thermometer: [Concealed] [Exposed].

H. Room thermostat accessories include the following:
   1. Insulating Bases: For thermostats located on exterior walls.
   2. Thermostat Guards: [Locking; heavy-duty, transparent plastic; mounted on separate base] [Metal wire, tamperproof] [Locking, solid metal, ventilated].
   3. Adjusting Key: As required for calibration and cover screws.
   4. Set-Point Adjustment: 1/2-inch- diameter, adjustment knob.

I. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable set point.

J. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.

K. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.
   2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

L. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above set point.
   2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

M. Heating/Cooling Valve-Top Thermostats: Proportional acting for proportional flow, with molded-rubber diaphragm, remote-bulb liquid-filled element, direct and reverse acting at
minimum shutoff pressure of 25 psig, and cast housing with position indicator and adjusting knob.

2.9 HUMIDISTATS

A. Manufacturers
   1. MAMAC Systems, Inc.
   2. ROTRONIC Instrument Corp.

B. Duct-Mounting Humidistats: Electric insertion, 2-position type with adjustable, 2 percent throttling range, 20 to 80 percent operating range, and single- or double-pole contacts.

2.10 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
   1. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
   2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
   3. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
   4. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
   5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
   6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
   1. Manufacturers
      a. Belimo Aircontrols (USA), Inc.
   2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
   3. Dampers: Size for running torque calculated as follows:
      b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
      c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. of damper.
      d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
      e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
      f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.

5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
7. Power Requirements (Two-Position Spring Return): [24] [120] [230]-V ac.
8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
10. Temperature Rating: [Minus 22 to plus 122 deg F] [40 to 104 deg F].
11. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
12. Run Time: [12 seconds open, 5 seconds closed] [30 seconds] [60 seconds] [120 seconds].

2.11 CONTROL VALVES

A. Manufacturers
2. Erie Controls
3. Magnatrol Valve Corporation
4. Neles-Jamesbury

B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

C. Hydronic system globe valves shall have the following characteristics:
1. NPS 2 and Smaller: Class [125] [250] bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
2. NPS 2-1/2 and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.
   a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
   b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.
4. Sizing: [3-psig] [5-psig] maximum pressure drop at design flow rate or the following:
   b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.
   c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.
5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.

D. Butterfly Valves: 200-psig, 150-psig maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
1. Body Style: [Wafer] [Lug] [Grooved].
2. Disc Type: [Nickel-plated ductile iron] [Aluminum bronze] [Elastomer-coated ductile iron] [Epoxy-coated ductile iron].
3. Sizing: 1-psig maximum pressure drop at design flow rate.

E. Terminal Unit Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.
1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
2. Sizing: 3-psig maximum pressure drop at design flow rate, to close against pump shutoff head.
3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

F. Self-Contained Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.
1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
2. Thermostatic Operator: [Wax] [Liquid]-filled [integral] [remote] sensor with [integral] [remote] adjustable dial.

2.12 DAMPERS

A. Manufacturers
1. Air Balance Inc.
2. Vent Products Company, Inc.

B. Dampers: AMCA-rated, [parallel] [opposed]-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.
1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with [oil-impregnated sintered bronze] [nylon] blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F.
3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. x lbf; when tested according to AMCA 500D.

2.13 CONTROL CABLE

A. Electronic and fiber-optic cables for control wiring are specified in Division 27 Section "Communications Horizontal Cabling."
2.14 PACKAGED AIR HANDLING UNIT CONTROLS (FOR REFERENCE, REFER TO SECTION 237413)

A. The unit shall be constructed so that it can function as a stand-alone heating and cooling system controlled by factory-supplied controllers, thermostats and sensors or it can be operated as a heating and cooling system controlled by a Building Management System (BMS). This unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various optional sensors.

B. Unit shall incorporate a DDC controller with integral LCD screen that provides text readouts of status. DDC controller shall have a built-in keypad to permit operator to access read-out screens without the use of ancillary equipment, devices or software. DDC controllers that require the use of equipment or software that is not factory-installed in the unit are not acceptable. Alarm readouts consisting of flashing light codes are not acceptable. Owner-specified ventilating conditions can be input by means of pushbuttons.

C. Unit supply fan shall be configured for Constant Volume (ON/OFF).

D. Unit exhaust fan shall be configured for Constant Volume (ON/OFF).

E. Outside Air / Return Air damper control shall be field adjustable two-position.

F. Variable Frequency Drive (VFD): unit shall have factory installed variable frequency drive for modulation of the supply and exhaust air blower assemblies. The VFD shall be factory-programmed for unit-specific requirements and shall not require additional field programming to operate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above the floor.

1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

B. Install guards on thermostats in the following locations:

1. Entrances
2. Public areas
3. Where indicated

C. Install automatic dampers according to Division 23 Section "Air Duct Accessories."

D. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

E. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."

F. Install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."
G. Install refrigerant instrument wells, valves, and other accessories according to Division 23 Section "Refrigerant Piping."

H. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.

I. Install electronic and fiber-optic cables according to Division 27 Section "Communications Horizontal Cabling."

3.2 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Install signal and communication cable according to Division 27 Section "Communications Horizontal Cabling."

   1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
   2. Install exposed cable in raceway.
   3. Install concealed cable in raceway.
   4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
   5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
   6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
   7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

   1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
   2. Test and adjust controls and safeties.
   3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. Test each point through its full operating range to verify that safety and operating control set points are as required.
5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

C. DDC Verification

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
6. Check temperature instruments and material and length of sensing elements.
7. Check control valves. Verify that they are in correct direction.
8. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
9. Check DDC system as follows:
   a. Verify that DDC controller power supply is from emergency power supply, if applicable.
   b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
   c. Verify that spare I/O capacity has been provided.
   d. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes packaged, outdoor, air-handling units (rooftop units) with the following components and accessories:

1. Direct-expansion cooling
2. Hot gas reheat coil
3. Supply and exhaust fans
4. Hot water heating coils
5. Energy Wheel
6. Integral, space temperature controls
7. Roof curbs

1.2 DEFINITIONS

A. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

B. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

C. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

D. Supply-Air Fan: The fan providing supply-air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

E. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

1.3 SUBMITTALS

A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.


C. Field quality-control test reports.

D. Operation and maintenance data.

E. Warranty.

1.4 QUALITY ASSURANCE

A. ARI Compliance

1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
2. Comply with ARI 270 for testing and rating sound performance for RTUs.

B. ASHRAE Compliance

1. Comply with ASHRAE 15 for refrigerant system safety.
2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
3. Comply with applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."


D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

E. UL Compliance: Comply with UL 1995.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.
3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
4. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

A. Available Manufacturers: Subject to compliance with specifications contained within this document, manufacturers offering products that may be incorporated into the work include, but are not limited to:

1. Mitsubishi Electric US, Inc.
2. LG
3. Aaon
4. Greenheck

2.2. MANUFACTURED UNITS

A. Unit shall be fully assembled at the factory and consist of an insulated metal cabinet, exhaust air blower, evaporator coil, energy wheel, hot water coil, hot gas reheat coil, packaged DX system, phase and brownout protection, motorized dampers, motorized recirculating damper, curb assembly, filter assembly intake air, supply air blower assembly, exhaust/relief blower assembly, filter assembly for exhaust air, and an electrical control center. All specified components and internal accessories factory installed are tested and prepared for single-point high voltage connection except with electric post heat which has dual point power.

2.3. CABINET

A. Materials: Formed, double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.

1. Outside casing: 22 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish. Pre-painted components as supplied by the factory shall have polyester urethane paint on 22 gauge G60 galvaneal steel. Unit’s exterior shall be supplied from the manufacturer using G60 galvaneal steel with proprietary pre-painted material in the following finish color; Concrete Gray-RAL 7023. This has been subjected to a salt spray test per ASTM-B117 and evaluated using ASTM-D714 and ASTM-D610 showing no observable signs of rust or blistering until reaching 2,500 hours.

2. Internal assemblies: 22 gauge, galvanized (G90) steel except for motor supports which shall be minimum 14 gauge galvanized (G90) steel.

B. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.

1. Materials: Rigid urethane foam
   a. Thickness: 2 inch (50 mm)
   b. Meets UL94HF-1 flame requirements.
   c. Location and application: Full coverage of entire cabinet exterior to include walls, roof of unit, unit base, and doors.
C. Access panels / doors: Unit shall be equipped with insulated, hinged doors or removable access panels to provide easy access to all major components. Doors and access panels shall be fabricated of 22 gauge galvanized G90 steel or painted galvannealed steel.

D. Supply Air blower assemblies: Blower assembly shall consist of an electric motor and direct-drive fans. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motors shall be capable of continuous speed modulation and controlled by a VFD.

E. Exhaust Air blower assemblies: Blower assembly shall consist of an electric motor and a direct-drive fan. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motor shall be capable of continuous speed modulation and controlled by a VFD.

F. Evaporator Coil: Evaporator coil shall be AHRI Certified and shall be (silver) soldered or brazed into the compressed refrigerant system. Coil shall be constructed of copper tubing, permanently bonded to aluminum fins and enclosed in a galvanized steel frame. If two compressors are used as components of the unit, then the evaporator coil shall be of "interlaced" configuration, permitting independent operation of either compressor without conflict with the other compressor.

G. Control panel / connections: Units shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections. RTU shall be equipped with a Unit Disconnect Switch.

H. Condensate drain pan: Drain Pan shall be an integral part of the unit whenever a cooling option is included. Pan shall be formed of welded austenitic stainless steel sheet material and provided with a welded stainless steel drain connection at the front for connection to a P trap. Drain pan shall be sloped in two directions to provide positive draining and drain connector shall be sealed at penetration through cabinet wall.

I. P trap: If the unit is equipped with a condensate drain pan, contractor shall provide, or fabricate, and install an appropriate P trap, in accordance with all local and area codes and Best Practices.

J. Energy wheel: Energy wheel shall be of total enthalpy, rotary air-to-air type and shall be an element of a removable energy wheel cassette. The cassette shall consist of a galvanized steel framework (designed to produce laminar air flow through the wheel), an energy wheel as specified and a motor and drive assembly. The cassette shall incorporate a pre-tensioned urethane drive belt with a five year warranty. The wheel media shall be a polymer film matrix in a stainless steel framework and be comprised of individual segments that are removable for servicing. Non-segmented energy wheels are not acceptable. Silica gel desiccant shall be permanently bonded to the polymer film and is designed and constructed to permit cleaning and servicing. The energy wheel is to have a five year warranty. Performance criteria are to be as specified in AHRI Standard 1060, complying with the Combined Efficiency data in the submittal.

K. Modulating frost control. Control system shall include an outdoor air thermostat and pressure sensor on the wheel assembly to initiate frost control sequence.
L. Hot water coil shall be factory installed and meet the design requirements as above.

M. Reheat coil with factory installed modulating hot gas reheat valve.

N. Packaged DX System: Unit shall have an integral compressor(s) and evaporator coil located within the weather-tight unit housing. Condenser coils and appurtenant condenser fan assemblies shall be factory installed as integral subassemblies of the unit and mounted on the exterior of the unit. Condenser fan shall have an external rotor motor with swept fan blades for low sound operation. Motors shall be UL Recognized and CSA Certified. The refrigerant compressor(s) shall be digital hermetic scroll-type and shall be equipped with liquid line filter drier, thermostatic expansion valves (TXV)(s), manual reset high pressure and low pressure cutouts and all appurtenant sensors, service ports and safety devices. Compressed refrigerant system shall be fully charged with R-410A refrigerant. Each compressor shall be factory-equipped with an electric crankcase heater to boil off liquid refrigerant from the oil.

O. Packaged DX Control and Diagnostics: The Packaged DX system shall be controlled by an onboard digital controller (DDC) that indicates both owner-supplied settings and fault conditions that may occur. The DDC shall be programmed to indicate the following faults:
   1. Global alarm condition (active when there is at least one alarm)
   2. Supply Air Proving alarm
   3. Dirty Filter Alarm
   4. Compressor Trip alarm
   5. Compressor Locked Out alarm
   6. Supply Air Temperature Low Limit alarm
      a. Sensor #1 Out of Range (outside air temperature)
      b. Sensor #2 Out of Range (supply air temperature)
      c. Sensor #3 Out of Range (cold coil leaving air temperature)

P. Phase and brownout protection: Unit shall have a factory-installed phase monitor to detect electric supply phase loss and voltage brown-out conditions. Upon detection of a fault, the monitor shall disconnect supply voltage to all motors.

Q. Motorized dampers / Intake Air, Exhaust Air, Motorized dampers of low leakage type shall be factory installed.

R. Curb Assembly: A curb assembly made of 14 gauge galvanized steel shall be provided by the factory for assembly and installation as part of this division. The curb assembly shall provide perimeter support of the entire unit and shall have duct adapter(s) for supply air and return air. Curb assembly shall enclose the underside of the unit and shall be sized to fit into a recess in the bottom of the unit. Contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration. Contractor shall provide and install appropriate insulation for the curb assembly. The curb shall be the height of 14 in..

2.4. BLOWER
A. Blower section construction, Supply Air: direct drive motors and blowers shall be assembled on a 14 gauge galvanized steel platform and shall be equipped with 1.125 inch thick neoprene vibration isolation devices.

B. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.

C. Fan: Direct drive, airfoil plenum fan with steel wheels statically and dynamically balanced and AMCA certified for air and sound performance.

D. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating".

2.5. MOTORS

A. General: Blower motors greater than 3/4 horsepower shall be "NEMA Premium" unless otherwise indicated. Compliance with EPAct minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure.

B. Motors shall be 60 cycle, 3 phase 460 volts.

2.6. UNIT CONTROLS

A. The unit shall be constructed so that it can function as a stand-alone heating and cooling system controlled by factory-supplied controllers, thermostats and sensors or it can be operated as a heating and cooling system controlled by a Building Management System (BMS). This unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various optional sensors.

B. Unit shall incorporate a DDC controller with integral LCD screen that provides text readouts of status. DDC controller shall have a built-in keypad to permit operator to access read-out screens without the use of ancillary equipment, devices or software. DDC controllers that require the use of equipment or software that is not factory-installed in the unit are not acceptable. Alarm readouts consisting of flashing light codes are not acceptable. Owner-specified ventilating conditions can be input by means of pushbuttons.

C. Unit supply fan shall be configured for Constant Volume (ON/OFF).

D. Unit exhaust fan shall be configured for Constant Volume (ON/OFF).

E. Outside Air / Return Air damper control shall be field adjustable two-position.

F. Variable Frequency Drive (VFD): unit shall have factory installed variable frequency drive for modulation of the supply and exhaust air blower assemblies. The VFD shall be factory-programmed for unit-specific requirements and shall not require additional field programming to operate.

2.7. FILTERS

A. Unit shall have permanent metal filters located in the outdoor air intake and shall be accessible from the exterior of the unit. MERV 8 disposable pleated filters shall be provided in the sup-
ply air stream. MERV 8 disposable pleated filters shall be provided in the supply final air stream and MERV 8 filters in the exhaust air stream.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment Mounting: Install RTUs on concrete base using restrained spring isolators. Comply with requirements for concrete base specified in Division 03.

1. Minimum Deflection: 1 inch.

B. Roof Curb: Install on roof structure, level and secure, according to ARI Guideline B. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Division 07 Section "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.

C. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.

D. Install wind restraints according to manufacturer's written instructions. Wind vibration isolation roof-curb rails are specified in Division 23 Section "Vibration Controls for HVAC Piping and Equipment."

E. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.

F. Install piping adjacent to RTUs to allow service and maintenance.

G. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to RTUs with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."
4. Install return-air duct continuously through roof structure.
5. Install normal-weight, 3000-psi, compressive strength (28-day) concrete mix inside roof curb, 4 inches thick. Concrete, formwork, and reinforcement are specified in Division 03.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.

C. Tests and Inspections

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

3.3 CLEANING AND ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.

B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

END OF SECTION
DIVISION 26

ELECTRICAL
PART 1   GENERAL

1.1   EXECUTION OF THE WORK

A. The scope of work shown on the drawings and in these specifications, Division 26, 27 and 28 are all a part of this contract and shall be included in the base bid unless otherwise noted.

B. These Specifications call out certain duties of the Electrical Contractor and/or Subcontractors. They are not intended as a material list of items required by the Contract.

C. These divisions of the Specifications cover the electrical systems of the project. It includes work performed by the electrical trades as well as trades not normally considered as electrical trades.

D. Provide all items and work indicated on the Drawings and all items and work called for in the Specifications in accordance with the conditions of Contract (Division 1 General Requirements Documents). This includes all incidentals, equipment, appliances, services, hoisting, scaffolding, supports, tools, supervision, labor, consumable items, fees, licenses, etc., necessary to provide complete systems. Perform start-up and checkout on each item and system to verify the systems are fully operable.

E. Comply with all provisions of the Contract Documents including Division 1, General Conditions, and Supplementary General Conditions of the Specifications.

F. Certain terms such as "shall, provide, install, complete, start up" are not used in some parts of these Specifications. This does not indicate that the items shall be less than completely installed or that systems shall be less than complete.

G. Examine and compare the Electrical Drawings and Specifications with the Drawings and Specifications of other trades, and report any discrepancies between them to the Engineer and obtain written instructions for changes necessary in the work. At time of bid the most stringent requirements must be included in said bid. Install and coordinate the electrical work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interferences in a manner approved by the Engineer. All changes required in the work of the Contractor caused by neglect shall be corrected at the expense of the Contractor.
H. It is the intent of the drawings and specifications to provide a complete workable system ready for the Owner’s operation. These specifications are equipment and performance specifications. Items described or called out in the specification but not shown on the drawings are considered to be part of the project. Any item not specifically shown on the drawings or called for in the specifications, but normally required to conform to the intent are to be considered a part of the contract. Installation of the equipment shall be in accordance with the N.E.C., manufacturer recommendation, and industry standards.

I. All material furnished by the Contractor shall be new and unused (temporary lighting and power products are excluded) and free from defects. All materials used shall bear the Underwriters Laboratory, Inc label provided a standard has been established for the material in question.

J. All products and materials to be new, clean, free of defects and free of damage and corrosion.

K. No exclusion from, or limitation in, the symbolism used on the Drawings for electrical work or the languages used in the Specifications for electrical work shall be interpreted as a reason for omitting accessories necessary to complete any required system or item of equipment.

L. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.

M. Except for conduit, conduit fittings, outlet boxes, wire and cable, all items of equipment or material shall be the product of one manufacturer throughout. Multiple manufacturers will not be permitted.

1.2 COORDINATION OF THE WORK

A. Certain materials will be provided by other trades. Examine the Contract Documents to ascertain these requirements.

B. Carefully check space requirements with other trades and the physical confines of the area to ensure that all material can be installed in the spaces allotted thereto including finished suspended ceilings. Make modifications thereto as required and approved.

C. Transmit to other trades all information required for work to be provided under their respective sections in ample time for installation.

D. Wherever work interconnects with work of other trades, coordinate with other trades to ensure that all trades have the information necessary so that they may properly install all the necessary connections and equipment. Identify all items of work that require access so that the ceiling trade will know where to install access doors and panels.
E. Due to the type of the installation, a fixed sequence of operation is required to properly install the complete systems. Coordinate, project and schedule work with other trades in accordance with the construction sequence.

F. The locations of lighting fixtures, outlets, panels and other equipment indicated on the Drawings are approximately correct, but they are understood to be subject to such revision as may be found necessary or desirable at the time the work is installed in consequence of increase or reduction of the number of outlets, or in order to meet field conditions or to coordinate with modular requirements of ceilings, or to simplify the work, or for other legitimate causes.

G. Exercise particular caution with reference to the location of panels, outlets, switches, etc., and have precise and definite locations approved by the Engineer before proceeding with the installation.

H. The Drawings show only the general run of raceways and approximate location of outlets. Any significant changes in location of outlets, cabinets, etc., necessary in order to meet field conditions shall be brought to the immediate attention of the Engineer and shall receive approval before such alterations are made. All such modifications shall be made without additional cost to the Owner.

I. Obtain from the Engineer in the field the location of such outlets or equipment not definitively located on the Drawings.

J. Circuit "tags" in the form of arrows are used where shown to indicate the home runs of raceways to electrical distribution points. These tags show the circuits in each home run and the panel designation. Show the actual circuit numbers on the finished record tracing and on panel directory card. Where circuiting is not indicated, the Electrical Contractor must provide required circuiting in accordance with the loading indicated on the drawings and/or as directed.

K. The Drawings generally do not indicate the exact number wires in each conduit for the branch circuit wiring of fixtures, and outlets, or the actual circuiting. Provide the correct wire size and quantity as required by the indicated circuiting and/or circuit numbers indicated and control wiring diagrams, if any, specified voltage drop or maximum distance limitations, and the applicable requirements of the NEC.

L. Adjust locations of conduits, panels, equipment, pull boxes, fixtures, etc. to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each raceway prior to installation.

1. Right of way: lines which pitch to have the right-of-way over those which do not pitch. For example: steam, condensate, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed to have right-of-way over lines whose elevations can be changed.
2. Make offsets, transitions and changes in direction in raceways and as required to maintain proper head room in pitch of sloping lines whether or not indicated on the Drawings.

M. Whenever the work is of sufficient complexity, prepare additional Detail Drawings to scale similar to that of the bidding Drawings, prepared on tracing medium of the same size as Contract Drawings. With these layouts, coordinate the work with the work of other trades. Such detailed work to be clearly identified on the Drawings as to the area to which it applies. Submit for review Drawings clearly showing the work and its relation to the work of other trades before commencing shop fabrication or erection in the field.

N. Contractor shall furnish services of experienced Superintendent, who shall be in constant charge of all work, and who shall coordinate his work with the work of other trades. No work shall be installed before coordinating with other trades.

1.3 WORK IN PRESENT BUILDING

A. All work shall be arranged so as to interfere as little as possible with the normal operation of the existing utilities. All connections and tie-ins shall be made so as to cause the least possible interruption of the normal schedule of the Building. Should an interruption or shutdown be required, this Contractor shall notify the Owner and the Architect sufficiently in advance of the required shutdown, so that proper arrangements may be made.

B. The Contractor shall arrange new hangers and supports so that conduit lines and equipment are not supported or suspended from the same floor and structural members as existing or new conduit and equipment. Hangers and supports shall be arranged to distribute the weight of the new lines and equipment uniformly on the present structure. Additional new structural members shall be furnished and installed as necessary to safely support the new conduit and equipment. New conduits larger than 2" diameter shall be supported from the top chord members of building structural steel. New conduits 2" diameter and smaller may be supported from the bottom chord members of building structural steel.
C. All present exposed conduit, wiring and similar miscellaneous items throughout the remodeled areas of the Building and not required as part of the remodeled installation, shall be completely removed. All present concealed conduit embedded in walls or located in inaccessible spaces and not required as a part of the remodeled installation, shall be suitably capped or plugged behind walls, above ceilings, or below floors and rendered completely "dead." When existing ceilings or wall construction is removed, resulting existing exposed conduit no longer required as part of the remodeled installation, shall be completely disconnected and removed. All such conduit services exposed to view shall be removed or relocated as required to serve existing facilities. Temporary conduit and equipment shall be installed as necessary to maintain continual electrical services in accordance with the various phases of the project. The Contractor shall furnish and install all conduit, wiring and equipment necessary to maintain and/or place in operation any portion of the Building in accordance with the phasing schedule. All hangers, etc., no longer required shall be removed wherever possible. Existing removed fixtures, switches, etc. that will remain the property of the Owner will be tagged by the Owner and the Electrical Contractor shall store these tagged items in a selected room in the Building and the Owner will remove the tagged items from this room. Present removed conduit, wiring and other miscellaneous electrical materials and equipment which are no longer required as a part of the new systems, shall become the property of the Contractor and shall be immediately removed from the site. The Electrical Contractor shall give due consideration and credit in his proposal for present conduit, materials and equipment which will become his property. Removed conduit, equipment and materials shall not be used as part of the new installation.

D. The Contractor shall provide all concrete work as necessary to perform all patch work under this Contract, such as for concrete floors, walls, and similar construction.

E. The Contractor shall relocate or replace existing conduit and wiring at various locations shown on the Drawings, as required to conform with new and existing revised building construction, and to clear new electrical systems. All conduit and wiring used for relocating or replacing the various circuits shall be new, of types specified, as required for each particular location.

F. All work shall be coordinated with the work of other trades and shall be performed in accordance with the Schedule of Work of the General Contractor and as required by the Architect and the Owner.

G. Generally, new ceilings will be installed throughout the Present Building in the remodeled areas by the General Contractor as noted on the General Construction Drawings. All wiring shall be concealed in these areas.
H. The General Contractor will remodel the Present Building in all areas shown on the Drawings. Also, new additions will be constructed under the General Contract. The Electrical Contractor shall refer to the General Construction Drawings to determine the extent of the remodeling work.

I. The Contractor shall visit the site to determine exact condition, locations, sizes and quantities of existing electrical equipment, wiring, conduit and other accessories which must be removed, revised, relocated, disconnected, connected to or reconnected. The Contractor will be held responsible for the removal of all existing electrical service equipment, panelboards, lighting fixtures, switches, receptacles, boxes, conduits, raceways, wiring, etc., throughout the Building and at the exterior of the Building no longer required as part of the newly remodeled building and the installation of new fixtures, switches, receptacles, motor outlets, panelboards, switchboard, equipment, conduit, raceways, wiring, boxes, etc., complete in every detail, unless noted otherwise. All existing electrical equipment such as, but not limited to; fluorescent fixture ballasts or capacitors containing PCB's or other hazardous materials shall be properly incinerated by the Electrical Contractor who shall provide "Demolition/Renovation Notification" as required by the Pennsylvania Department of Environmental Resources, Bureau of Air Quality Control." The Contractor is solely responsible for identifying and removing all hazardous materials and waste which it uses or generates.

J. Removal of the existing service and the installation of a new electrical service and equipment shall be coordinated with work being performed under the other contracts and with the power company.

K. All work shall be performed as previously described under "Description of Work" as shown on the Drawings, and as herein specified. New equipment, switchboard, panelboards, lighting fixtures, receptacles, switches, conduit, wiring, boxes, and special systems shall be furnished and installed as shown and specified.

L. Existing heating, ventilating, plumbing and miscellaneous equipment will be removed under the Heating, Plumbing and General Contracts. The Electrical Contractor shall disconnect the equipment from their present electrical services and remove all wiring, conduit, boxes, switches, etc., no longer required. New equipment will be furnished and installed under other contracts and shall be connected by the Electrical Contractor to the new electrical system as shown and as required for a complete installation.
M. Existing exposed conduit, raceways, etc., no longer required shall not be reused as a part of the new system and shall be removed from the site. Present concealed wiring shall be disconnected and removed wherever possible; however, where it is impracticable to do so, the wiring shall be rendered completely "dead". Present concealed conduit and boxes no longer required may remain but shall be rendered completely "dead". Present remaining conduits and boxes may be used for the installation of new wiring where the conduits and boxes are in good condition and where it is feasible to do so, and where the installation will conform with applicable codes and regulations. Removed wiring, conduits, and boxes shall not be reused as a part of the new installation.

N. New conduits shall be run concealed above new or existing ceilings wherever possible. New acoustical tile ceilings will be installed in various remodeled areas throughout the Building under the General Contract. Where existing ceilings remain and are not to be replaced by the General Contractor, the Electrical Contractor shall be completely responsible for removing, storing and resetting ceiling tile, cutting, removing and resetting ceiling supports, grids, etc., or perform any other work as necessary to complete each installation above the existing ceilings under this Contract. Where new ceilings are installed below existing remaining ceilings, the Electrical Contractor will be responsible for the repair of the existing ceilings where they are damaged or penetrated under this Contract, as required to maintain the fire rating of the existing ceilings.

O. The Contractor shall perform all cutting and patching required for the installation of new conduit, boxes, raceways, equipment, etc., and for the removal of present equipment, wiring, conduit, boxes, etc., as hereinafter specified.

1.4 EXAMINATION OF SITE

A. Prior to submitting of bids, the Contractor shall visit the site of the job and shall familiarize himself with all conditions affecting the proposed installation and shall make provisions as to the cost thereof. Failure to comply with the intent of this paragraph will in no way relieve the Contractor of performing all necessary work shown on the Drawings.

1.5 PROGRESS OF WORK

A. The Contractor shall order the progress of his work so as to conform to the progress of the work of other trades and shall complete the entire installation as soon as the conditions of the building will permit. Any cost resulting from the defective or ill-timed work performed under this section shall be borne by the Contractor.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING
A. Ship and store all products and materials in a manner which will protect them from damage, weather and entry of debris. If items are damaged, do not install, but take immediate steps to obtain replacement or repair. Any such repairs shall be subject to review and acceptance of the Engineer.

B. Delivery of Materials: Deliver materials (except bulk materials) in manufacturer's unopened container fully identified with manufacturer's name, trade name, type, class, grade, size and color.

C. Storage of Materials, Equipment and Fixtures: Store materials suitably sheltered from the elements, but readily accessible for inspection by the Engineer until installed. Store all items subject to moisture damage in dry, heated spaces.

1.7 EQUIPMENT ACCESSORIES

A. Establish sizes and location of the various concrete bases required. Coordinate with General Contractor and provide all necessary anchor bolts together with templates for holding these bolts in position.

B. Provide supports, hangers and auxiliary structural members required for support of the work.

C. Furnish and set all sleeves for passage of raceways through structural, masonry and concrete walls and floors and elsewhere as will be required for the proper protection of each raceway and passing through building surfaces.

D. Wall mounted equipment, total weight of 100 pounds or less, may be directly secured to wall by means of steel bolts. Maintain at least 1" air space between equipment and supporting wall. Groups or arrays of equipment, with total weight of more than 100 pounds, shall be mounted on adequately free standing sized steel angles, channels, or bars. Prefabricated steel channels providing a high degree of mounting flexibility, such as those manufactured by Kindorf, Globe-Strutt and Unistrut, may be used for mounting arrays of equipment.

1.8 CUTTING, PATCHING, ETC.

A. The work shall be carefully laid out in advance. Where Cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support or anchorage of raceway, outlets or other equipment, the work shall be carefully done. Any damage to the building, piping, equipment or defaced finish plaster, woodwork, metalwork, etc. shall be repaired by skilled mechanics of the trades involved at no additional cost to the Owner.

B. The Contractor shall do no cutting, channeling, chasing or drilling of unfinished masonry, tile, etc., unless he first obtains permission from the Engineer. If permission is granted, the Contractor shall perform this work in a manner approved by the Engineer.
C. Where conduits, outlet, junction, or pullboxes are mounted on a painted surface, or a surface to be painted, they shall be painted to match the surface. Whenever support channels are cut, the bare metal shall be cold galvanized.

D. Slots, chases, openings and recesses through floors, walls, ceilings, and roofs will be provided by the various trades in their respective materials. The trade requiring them to properly locate such openings and be responsible for any cutting and patching caused by the neglect to do so.

1.9 NOMINAL VOLTAGES (UNLESS OTHERWISE NOTED)

A. Secondary distribution: 277/480 volt, 3 phase, 4 wire.

B. Secondary Distribution: 120/208 volt, 3 phase, 4 wire.

1.10 MOUNTING HEIGHTS

A. Unless otherwise noted or required because of special conditions, locate outlets as follows:
   1. Heights listed are from finished floor to center of device. Verify exact locations with the Engineer before installation.
      a. Wall switch outlets .................................................................42"
      b. Bracket outlets .................................................................7'- 0" to bottom
      c. Convenience outlets (general) .............................................18"
      d. Convenience outlets (mechanical areas) ...........................4' - 0"
      e. Panelboard and distribution cabinet to top .......................6' - 6"
      f. Fire alarm audio unit .........................................................Lower of 80" AFF or 6" below ceiling
      g. Fire alarm visual unit .........................................................80" to bottom or 96" to top AFF
      h. Fire alarm stations ...............................................................40" to top
      i. Desk telephone outlets ..........................................................18"
      j. Wall telephone outlets .........................................................4' - 9"
      k. Television outlets ...............................................................1' - 6"

1.11 CLEANING UP

A. Contractor shall take care to avoid accumulation of debris, boxes, crates, etc. resulting from the installation of work. Contractor shall remove from the premises each day all debris, boxes, etc., and keep the premises clean, subject to the Architect's instructions, which shall be promptly carried out.

B. Contractor shall clean all fixtures and equipment at the completion of the project.

C. All switchboards, panelboards, wireway, trench ducts, cabinets, enclosures, etc. shall be thoroughly vacuumed clean prior to energizing equipment at the completion of the project. Equipment shall be opened for observation by the Architect as required.
1.12 WATERPROOFING

A. Avoid, if possible, the penetration of any waterproof membranes such as roofs, machine room floors, basement walls, and the like. If such penetration is necessary, perform it prior to the waterproofing and furnish all sleeves or pitch-pockets required. Advise the Architect and obtain written permission before penetrating any waterproof membrane, even where such penetration is shown on the Drawings. Perform work so as to maintain any warranties currently in effect.

B. If this Contractor penetrates any walls or surfaces after they have been waterproofed, this Contractor shall restore the waterproof integrity of that surface at the expense of this Contractor and as directed by the Architect.

1.13 PRODUCTS

A. If products and materials are specified or indicated on the drawings for a specific item or system, use those products or materials. Where noted in other sections of this specification, equipment has been specified for a specific performance and substitutions are not permitted. If products and materials are not listed in either of the above, use first class products and materials, subject to approval of Shop Drawings where Shop Drawings are required or as approved in writing where Shop Drawings are not required.

1.14 OMISSIONS FROM THE DRAWINGS

A. Should a Bidder find discrepancies in or omissions from the drawings or specifications or be in doubt as to their meaning, he shall notify the Architect before submitting his proposal. The Architect will in turn, send written instructions to all Bidders. Neither the Architect nor the Owner will be responsible for oral instructions. If the Contractor fails to comply with this requirement, he shall accept the Engineer's interpretations as to the intended meaning of the drawings and specifications.

1.15 EXECUTION

A. Follow manufacturer's instructions for installing, connecting, and adjusting all equipment. Provide one copy of such instructions to the Architect before installing any equipment. Provide a copy of such instructions at the equipment during any work on the equipment. Provide all special supports, connections, wiring, accessories, etc.

B. Use mechanics skilled in their trade for all work.

C. Clean all items before and after installation. Clean up all debris.
D. Perform all tests required by local authorities in addition to tests specified herein, such as life safety systems.

E. Applicable equipment and materials to be listed by Underwriters' Laboratories and manufactured in accordance with ASME, NEMA, ANSI or IEEE standards and as approved by local authorities having jurisdiction.

F. Before commencing work, examine all adjoining, underlying, etc., work on which this work is in any way dependent for perfect workmanship and report any condition which prevents performance of first class work. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.

1.16 VERIFICATION OF ELECTRICAL REQUIREMENTS FOR EQUIPMENT FURNISHED BY OTHERS

A. Prior to the installation of wiring systems for any equipment furnished by others, this contractor shall verify that the electrical requirements of the equipment match those shown on the electrical drawings by examining the approved shop drawings of that equipment. Any discrepancies shall be immediately reported to the engineer.

B. If the contractor fails to comply with this requirement, he shall be responsible for any additional costs incurred at no additional cost to the Owner.

1.17 PROTECTION OF BUILDING FIRE/SMOKE BARRIERS

A. Passages of conduit through fire barriers and/or smoke barriers shall be protected as follows:
   1. The space between the penetrating item and the fire barrier and/or smoke barrier shall be filled with a material capable of maintaining the fire/smoke resistance of the barrier or be protected by an approved device designed for the specific purpose.
   2. Where the penetrating item uses a sleeve to penetrate the fire and/or smoke barrier the sleeve shall be solidly set in the fire/smoke barrier and the space between the item and the sleeve shall be filled as described above.
   3. Fire barriers shall include 1-hour, 2-hour, and 3-hour rated floors and walls. Refer to architectural plans for location of fire barriers and smoke barriers and provide protection required to maintain ratings in accordance with all codes.
   4. Approved fill material for fire barriers shall be packed mineral wool, with ASTM-136 rating and 3M Fire Barrier caulk. Coordinate sealing of all openings with requirements of Division 7 of this specification.
   5. Perform work in accordance with the appropriate UL Ratings.
   6. Product Data: Provide manufacturer's specifications, recommendations and installation instructions for each application.

1.18 CODES AND FEES
A. General: Comply with Codes in accordance with the Contract Documents.

B. The electrical installation shall be in compliance with the requirements of OSHA, NEC and the rules, regulations and requirements of the power company supplying power to the building.

C. The electrical installation shall comply fully with all township, county and state laws, ordinances and regulations applicable to electrical installations.

D. All equipment shall be equal to or exceed the minimum requirements of NEMA, IEEE and UL.

E. Should any change in Drawings or Specifications be required to comply with governmental regulations, the Contractor shall notify Architects prior to execution of the work. The work shall be carried out according to the requirements of such code in accordance with the instruction of the Architect and at no additional cost to the Owner.

F. The local fees and permits and services of inspection authorities shall be obtained and paid for by the Contractor. The Contractor shall cooperate fully with local utility companies with respect to their services.

G. Certificate of Inspection and approval shall be procured and paid for by this Contractor from an approved certified inspection agency.

1.19 GUARANTEE

A. General: Provide a Guarantee in accordance with the Contract Documents.

B. Submit a single guarantee stating that all portions of the work are in accordance with Contract requirements. Guarantee all work against faulty and improper material and workmanship for a period of one (1) year from date of final acceptance by the Owner, except that where guarantees or warranties for longer terms are specified herein, such longer term to apply. Within 24 hours after notification, correct any deficiencies which occur during the guarantee period at no additional cost to Owner, all to the satisfaction of the Owner and Architect. Obtain similar guarantees from subcontractors, manufacturers, suppliers and subtrade specialists.

1.20 DISPOSAL

A. All electrical items not designated by the Owner for his use to be properly disposed of according to local, state and Federal regulations.

B. Items containing polychlorinated biphenyl (PCB) to be removed, transported and disposed of according to Federal Toxic Substances Control Act (TSCA). Contractor to submit certification that these items have been properly disposed.
1.21 EXCAVATION AND TRENCHING

A. Provide excavation for the work. Excavate all material encountered to the depths indicated on the Drawings or required. Remove from the site excavated materials not required or suitable for backfill. Provide grading as may be necessary to prevent surface water from flowing into trenches or other excavations. Remove any water accumulating therein. Provide sheeting and shoring as may be necessary for the protection of the work and for the safety of personnel.

B. Provide trenches of widths necessary for the proper execution of the work. Grade bottom of the trenches accurately to provide uniform bearing and support the work on undisturbed soil at every point along its entire length. Where rock excavations are required, excavate rock to a minimum overdepth of 4 inches below the trench depths indicated on the Drawings or required. Backfill overdepths in the rock excavation and unauthorized overdepths with loose, granular, moist earth, thoroughly machine tamped to a compaction level as specified by the Engineer. Whenever unstable soil incapable of properly supporting the work is encountered in the bottom of the trench as determined by the Engineer, remove soil to a depth required and backfill the trench to the proper grade with coarse sand, fine gravel or other suitable material.
   1. Primary electric service:  4 feet (minimum).
   2. Secondary electric service:  2 feet (minimum).
   3. Telephone service:  2 feet (minimum).

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION
1.1 DESCRIPTION

A. Utilize the following abbreviations and definitions for discernment within the Drawings and Specifications.

1. Abbreviations
   a. NEC National Electrical Code
   b. OSHA Occupational Safety and Health Act
   c. ANSI American National Standards Institute
   d. NFPA National Fire Protection Association
   e. ASA American Standards Association
   f. IEEE Institute of Electrical and Electronics Engineers
   g. NEMA National Electrical Manufacturers Association
   h. UL Underwriters' Laboratories, Inc.
   i. IES Illuminating Engineering Society
   j. ICEA Insulated Cable Engineers Association
   k. ASTM American Society of Testing Materials
   l. ETL Electrical Testing Laboratories, Inc.
   m. CBM Certified Ballast Manufacturers
   n. EIA Electronic Industries Association
   o. OEM Original Equipment Manufacturer
   p. ADA Americans with Disabilities Act

2. Definitions
   a. "PROVIDE" means to supply, purchase, transport, place, erect, connect, test and turn over to Owner, complete and ready for regular operation, the particular work referred to.
   b. "INSTALL" means to join, unite, fasten, link, attach, set up or otherwise connect together before testing and turning over to Owner, complete and ready for regular operation, the particular work referred to.
   c. "FURNISH" means to supply all materials, labor, equipment, testing apparatus, controls, tests, accessories and all other items customarily required for the proper and complete application for the particular work referred to.
   d. "WIRING" means the inclusion of all raceways fittings, conductors, connectors, tape, junction and outlet boxes, connections, splices, and all other items necessary and/or required in connection with such work.
   e. "CONDUIT" means the inclusion of all fittings, hangers, supports, sleeves, etc.
   f. "AS DIRECTED" means as directed by the Architect or his representative.
g. "CONCEALED" means embedded in masonry or other construction, installed behind wall furring or within double partitions or installed within hung ceilings.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION
PART 1 GENERAL

1.1 DESCRIPTION

A. General: Provide the work included in accordance with the Contract Documents.

B. Provide all labor, materials, equipment, tools, appliances, auxiliaries, services, hoisting, scaffolding, support, supervisions, Project Record Documents, and perform all operations noted in the Documents. Perform all operations for the furnishing and installation of the complete electrical system, including, but not limited to, the work described hereinafter. The work shall meet or exceed the latest codes, regulations and requirements of the state and local community.

C. The electrical work is shown schematically on the Drawings to indicate the general system arrangement and configuration. The work of this Division shall include coordination with the work of other Divisions of the Specifications and the Contract Documents so as to provide complete and operational systems capable of being readily operated and maintained, to the Owner’s satisfaction.

D. The work includes, but is not limited to the following:
   1. Alterations and additions to existing power distribution system
   2. Lighting system
   3. Power distribution system
   4. Telecommunication system
   5. Fire alarm system additional devices
   6. Auditorium stage equipment and dimming system
   7. Integrated AV systems and equipment.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION
PART 1 GENERAL

1.1 SUBSTITUTION OF MATERIALS OR EQUIPMENT

A. Reference shall be made to Division 012500 "Substitutions Procedures", for substitution of material or equipment in this Division of the Specifications.

1.2 SHOP DRAWINGS

A. Prepare and submit detailed shop drawings for materials, systems and equipment as listed herein, including locations and sizes of all openings in floor decks, walls and floors.

B. The work described in any shop drawing submission shall be carefully checked for all clearances (including those required for maintenance and servicing), field conditions, maintenance of architectural conditions and proper condition with all trades on the job. Each submitted shop drawing shall include a certification that all related job conditions have been checked and that no conflict exists.

C. All drawings shall be submitted sufficiently in advance of final requirements to allow ample time for checking and resubmittal as may be required. All submittals shall be complete and contain all required and detailed information.

D. Acceptance of any submitted data or shop drawings for material, equipment apparatus, devices, arrangement and layout shall not relieve Contractor from responsibility of furnishing same of proper dimensions and weight, capacities, sizes, quantity, quality and installation details to efficiently perform the requirements and intent of the contract. Such acceptance shall not relieve contractor from responsibility for errors, omissions or inadequacies of any sort on submitted data or shop drawings.

E. Each shop drawing shall contain job title and reference to the applicable drawing and specification article.

1.3 SHOP DRAWING SUBMITTALS

A. Certified Submittals
   1. All electrical materials, devices, appliances and equipment shall be labeled and listed by a certified testing laboratory or agency.

B. Submit for the Architect’s approval shop drawings of the following and any other shop drawings requested:
   1. Panelboards
   2. Lighting fixtures
   3. Fire alarm system
4. Safety switches
5. Wiring devices
6. Theatrical lighting system
7. Auditorium sound system
8. Cat 6 cabling system and devices

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION
PART 1  GENERAL

1.1  DESCRIPTION

A. General: Provide maintenance manuals in accordance with the Contract Documents.

1.2  SUBMITTALS

A. Provide three (3) copies of each manual.

B. Manuals to be 8-1/2 inches x 11 inches size in hard back 3-ring loose-leaf binders. Use more than one volume if required; do not overfill binders.

C. Submit one (1) copy to Architect. After review and acceptance, assemble other copies.

D. Manuals to be completed and in Owner's hands prior to turning building over to Owner and at least 10 days prior to instruction to operating personnel.

PART 2  PRODUCTS

2.1  MANUFACTURERS' LITERATURE

A. General: Provide manufacturers' literature on all items of equipment and components as regularly published by the respective manufacturers for proper preventative and comprehensive maintenance.

PART 3  EXECUTION

3.1  PROVIDE MAINTENANCE MANUALS INCLUDING BUT NOT LIMITED TO THE FOLLOWING:

A. Alphabetical list of all system components, with the name, address, and 24-hour phone number of the company responsible for servicing each item during the first year of operation.

B. Operating instructions for complete system including:
   1. Normal starting, operating, and shut-down.
   2. Emergency procedures for fire or failure of major equipment.

C. Maintenance instructions including:
1. Proper lubricants and lubricating instructions for each piece of equipment, and
date when lubricated.
2. This shall be a separate list in addition to manufacturers' data.
3. Necessary cleaning, replacement and/or adjustment schedule.

D. Manufacturers' data on each piece of equipment including:
   1. Installation instructions.
   2. Drawings and specifications.
   3. Parts list, including recommended items to be stocked.
   4. Complete wiring diagrams.
   5. Marked or changed prints locating all concealed parts and all variations from
      the original system design.
   6. Test and inspection certificates.

END OF SECTION
PART 1 GENERAL

1.1 DESCRIPTION

A. General: Complete testing of equipment and systems shall be provided throughout in accordance with the Contract Documents.

1.2 STANDARDS

A. Except as modified by governing codes and by the Contract Documents comply with the latest applicable provisions and the latest recommendations of the following:
   1. Industry standards shall apply except as otherwise specified.

1.3 APPLICABLE CODES, STANDARDS AND REFERENCES

A. All inspections and tests shall be in accordance with the following applicable codes and standards except as provided otherwise herein.
   1. National Electrical Manufacturer's Association – NEMA
   2. American National Standards Institute – ANSI
   3. Institute of Electrical and Electronic Engineers – IEEE
   7. Insulated Power Cable Engineers Association – IPCEA
   8. Association of Edison Illuminating Companies – AEIC
   9. Occupational Safety and Health Administration – OSHA
   10. State and local codes and ordinances
   11. Applicable Independent Testing Associations Specifications

B. All inspections and tests shall utilize the following references:
   1. Project design specifications
   2. Project design drawings
   3. Manufacturer's instruction manuals applicable to each particular apparatus.

1.4 SUBMITTALS

A. The test report shall include the following:
   1. Summary of project
   2. Description of equipment tested
   3. Description of test
   4. Test results
   5. Conclusions and recommendations
   6. Appendix, including appropriate test forms
   7. List of test equipment used and calibration date
8. Conditions for future access to secured computer database of all Test Data.

B. Furnish three copies of the completed report to the project engineer no later than 30 days after completion of the project, unless directed otherwise.

1.5 SAFETY AND PRECAUTIONS

A. Safety practices shall include, but are not limited to, the following requirements:
   3. Applicable state and local safety operating procedures.

B. All tests shall be performed with apparatus de-energized except where otherwise specified.

C. The engineering service testing group's lead test engineer for the project shall be a designated safety representative and shall be present on the project and supervise testing operations and safety requirements.

D. Power circuits shall have conductors shorted to ground by a hotline grounded device approved for the purpose in accordance with the appropriate test procedures.

E. In all cases, work shall not proceed until the safety representative has determined that it is safe to do so.

F. The engineering service testing group shall have available sufficient protective barriers and warning signs, where necessary, to conduct specified tests safely.

G. The owner's safety procedures shall be reviewed and understood by the engineering service testing group personnel.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide all labor, premium labor and materials required by shop and field testing as specified in the Contract Documents and as required by the authorities having jurisdiction.

2.2 SYSTEMS

A. The following systems are to be tested, inspected and certified.
   1. Wire and Cable (600 Volts and Below)
      a. Inspect all splices and terminations and make mechanically and electrically tight during a fifteen (15) day period immediately prior to final acceptance of the work.
b. Insulation System – To ensure integrity of the cable insulation system after shipping, site storage, and pulling through conduit an insulation resistance test will reveal insulation deformities and moisture in the cable that otherwise might cause an untimely premature cable failure possibly damaging equipment or personnel. Perform the following on all customer power cables to and from main switchboard. This would include cables from utility transformer to MSB and cables from MSB to all secondary switchboards or distribution panels.

c. Visually inspect visible portion of cables for observable defects.

d. Ensure all solid-state devices are disconnected from the system prior to meggering. Typically but not all-inclusive would be Meters, trip units with voltage sensing, and SPD units.

e. Isolate cables by opening breakers. Meggering thru equipment like motors or transformers will produce erroneous readings.

f. Perform insulation-resistance tests on each line and load cable, phase-to-phase, phase-to-ground, phase-to-neutral and neutral-to-ground in each conduit. Megger at 1000 VDC for 600 volt cable and 500 VDC for 300 volt cable for one minute.

g. Insulation resistance shall be above 100 ohms and preferably above one megohm.

h. Ensure cable termination connections are tight after testing.

2. Motors

a. Test all motors under load and verify that motor rotation is correct.

3. Fire Alarm Systems

a. All wiring must be inspected and tested to insure that there are no grounds, opens or shorts. The minimum allowable resistance between any two conductors or between conductors and ground is ten (10) megohms as measured with a 500 volt meager after all conduit, conductors, detector bases, etc., have been installed, but before the detector devices are plugged into the bases or end-of-line devices installed.

b. The Contractor must perform all electrical and mechanical tests required by the equipment manufacturer's form. All test and report costs must be in the Contract price. A checkout report is to be prepared by the technician and submitted in triplicate, one copy of which will be registered with the equipment manufacturer. The report is to include, but not be limited to:

1) A complete list of equipment installed and wired.
2) Indication that all equipment is properly installed and functions and conforms with these specifications.
3) Tests of individual zones as applicable.
4) Serial numbers, locations by zone and model number for each installed detector.
5) Voltage (sensitivity) settings for each ionization detector as measured in place.
6) Response time on detectors.
7) Contractor shall submit a certified report indicating the following:
a) Operating all manual stations and all detectors that can be reset.

b) Verifying line supervision of each initiating and indicating circuit.

c) Verifying the operation of each initiating circuit.

d) Verifying the operation of all indicating devices.

e) Verifying the operation of all alarm-initiated functions.

f) Verifying full operation of the F.C.I.P.

PART 3 EXECUTION

3.1 GENERAL

A. Notify the Architect seven (7) days prior to the testing dates. If the Architect so elects not to witness a specific test a statement of certification must be forwarded to the Architect for his approval.

B. Conduct tests at a time agreeable to the Architect. Provide premium labor as necessary.

C. Products which are found defective or do not pass such tests shall be removed and replaced at the Contractor's expense. Tests shall be repeated.

D. Conduct all test required by the authorities having jurisdiction.

3.2 RESTORATION OF EQUIPMENT AND REPORTS

A. Before Energizing
   1. Remove and account for all test equipment, jumper wires, and tools used during testing.
   2. Remove and account for safety grounds and tools.
   3. Replace all barriers and covers, close all doors, and secure all latches.
   4. Remove safety locks and tags.
   5. Ensure all adjustable meters, relays and trip devices are properly set in accordance with the coordination study.
   6. Apply testing label to equipment

B. Note corrective actions taken, deficiencies, recommendations and any general comments.

C. Finish recording data on test forms, completely filling in the blanks. Enter into electronic database as required in section 1.4.E

D. Turn in 3 copies of report to engineer for approval.

3.3 FOLLOW UP TESTING
A. Included in above cost as part of original project.

B. One month prior to the expiration of the factory warranty schedule & perform a thermal scan of all breaker to cable, breaker, bus connections, cable to panel chassis. Scope is to include main transformer connections, main switchboard, all secondary switchboards, transformers, and panels. Tests are to be done with building normal loaded for 2 hours, not with partial or unloaded condition.

C. Thermal scan temperatures shall be evaluated as follows (based on comparable size or adjacent phases and loaded breakers, bus connections, and terminations)
   1. 1-3 degrees C rise, Investigate as to the cause of temp rise.
   2. 4 – 15 degree C rise, Repair as soon as possible.
   3. 16 or higher degree C rise, Repair immediately.

D. Ensure that all bus and breaker to cable connections are tight.

E. Note corrective actions taken, deficiencies, recommendations and any general comments.

F. Finish recording data on test forms, completely filling in the blanks.

G. Turn in 3 copies of report to engineer for approval.

END OF SECTION
SECTION 26 05 19 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 1 Specification Section, apply to this Section.

1.2 SUMMARY

A. General: Provide 600 volt wire and cable in accordance with the Contract Documents.

1.3 STANDARDS

A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
   1. Underwriters Laboratory Standard No. UL 467
      a. ASTM
      b. IPECA
   2. Terminal Blocks
      a. UL-1059

PART 2 PRODUCTS

2.1 WIRE AND CABLE

A. General
   1. Provide wire with a minimum insulating rating of 600 volts, except for wire used in 50 volts or below applications for control of signal systems use 300 volt minimum or 600 volt where permitted to be incorporated with other wiring systems.

B. Conductor
   1. Electrical grade, annealed copper fabricated in accordance with ASTM standards. Minimum size number 12 for branch circuits; number 14 for control wiring.
   2. The conductors shown on the drawings are copper, except as noted otherwise.

C. Stranding and Number of Conductors
   1. Number 12 and number 10 solid.
   2. Cables larger than number 10, stranded in accordance with ASTM Class B stranding designations.
   3. Control wires stranded in accordance with ASTM Class B stranding
designations.

4. Cables, multi-conductor unless otherwise noted for low tension systems.

D. Insulation

1. Type THWN/THHN insulation suitable for use in wet locations up to 75 degrees Centigrade. Use for lighting, receptacle and motor circuits and for panel and equipment feeders.

2. Type THHN – Flame retardant: Heat-resistant thermoplastic insulation, nylon jacket rated for 90 degrees Centigrade operation. Use for lighting branch circuit wiring installed and passing through the ballast channels of fluorescent fixtures, wiring in metal roofdecks in or near roof insulation, in attic or joist spaces, or in raceways exposed to the sun.

3. Type XF – Crosslinked polyolefin insulated heat-resistant wire suitable for 150 degrees Centigrade operation. Use for fixture wiring or any wiring within 3 feet horizontally or 10 feet above any furnace, boiler or similar appliance.

E. 2-Hour Fire Rated Wiring System (MI)

1. Cable shall be 2-hour rated, UL rated with copper sheath. Cable shall be factory assembled of one or more conductors insulated with highly compacted magnesium oxide insulation and enclosed in a seamless, liquid- and gas-tight continuous copper sheath.

2. Conductors shall be solid, high electrical conductivity copper with cross section corresponding to the standard N.E.C. AWG sizes.

3. Insulation shall be of highly compressed magnesium oxide that provided proper spacing for the conductors. Thickness of the insulation shall be at least 55 mils for all 600 volt power or control cables.

4. Cable and installation shall comply with N.E.C. Article 332. Cables must be supported per for manufacturers recommendations.

5. Cable shall be Pentair System 1850 or approved equal. Provide shop drawings of cable and fittings.

F. Color Coding

1. Provide consistent color coding of all feeders, sub feeders, motor circuits and the likes as follows:

<table>
<thead>
<tr>
<th>120/208 Volts Code</th>
<th>277/480 Volts Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase A - Black</td>
<td>Phase A - Brown</td>
</tr>
<tr>
<td>Phase B - Red</td>
<td>Phase B - Orange</td>
</tr>
<tr>
<td>Phase C - Blue</td>
<td>Phase C - Yellow</td>
</tr>
<tr>
<td>Neutral - White</td>
<td>Neutral - Gray</td>
</tr>
<tr>
<td>Ground - Green</td>
<td>Ground - Green w/Yellow Stripe</td>
</tr>
</tbody>
</table>

2. Color code wiring for control systems installed in conjunction with mechanical and/or miscellaneous equipment in accordance with the wiring diagrams furnished with the equipment. Factory color code wire number 2 and smaller. Wire number 1 and larger may be color coded by color taping of the entire length of the exposed ends.
2.2 CONNECTORS

A. Make connections, splices, taps and joints with solderless devices, mechanically and electrically secure. Protect exposed wires and connecting devices with electrical tape or insulation to provide not less than that of the conductor.

B. Branch Circuit wires (Number 10 and smaller): Use any of the following types of terminals and connecting devices:
   1. Hand Applied
      a. Coiled tapered, spring wound devices with a conducting corrosion-resistant coating over the spring steel and a plastic cover and skirt providing full insulation for splice and wired ends. Screw connector on by hand.
   2. Tool Applied
      a. Steel cap, with conduction and corrosion resistant metallic plating, open at both ends, fitted around the twisted ends of the wire and compressed or crimped by means of a special die designed for the purpose. Specifically fitted plastic or rubber insulating cover wrap over each connector.

2.3 ELECTRICAL TAPE

A. Specifically designed for use as insulating tape.

2.4 LUBRICANT

A. Use lubricant only where the possibility of damage to conductors exists. Use only a lubricant approved by the cable manufacturer and one which is inert to cable and raceways.

PART 3 EXECUTION

3.1 WIRE AND CABLE

A. Provide a complete system of conductors in raceway system. Mount wiring through a specified raceway, regardless of voltage application.

B. Drawings do not indicate size of branch circuit wiring. For branch circuits whose length from panel to furthest outlet exceeds 100 feet for 120-volt circuits, use number 10 or larger.

C. Do not install wire in incomplete conduit runs nor until after the concrete work and plastering is completed and moisture is swabbed from conduits. Eliminate splices wherever possible. Where necessary, splice in readily accessible pull, junction, or outlet.

D. Provide cable supports for all vertical risers where required by code.
E. Flashover or insulation value of joints to be equal to that of the conductor. Provide Underwriters Laboratories listed connectors rated at 600 volts for general use and 1,000 volts for use between ballasts and lamps or gaseous discharge fixtures.

F. Use terminating fittings, connectors, etc., of a type suitable for the specified cable furnished. Make bends in cable at termination prior to installing compression device. Make fittings tight.

G. Extend wire sizing for the entire length of a circuit, feeder, etc. unless specifically noted otherwise.

H. Provide a separate neutral conductor for each branch circuit. In the event a common neutral conductor is used, such as in furniture systems, the circuit breaker in the panelboard must be common trip for each phase that uses one neutral conductor.

END OF SECTION
SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 1 Specification Section, apply to this Section.

1.2 SUMMARY

A. General: Provide a low impedance grounding system in accordance with the Contract Documents.

1.3 STANDARDS

A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
   1. Underwriters Laboratory Standard No. UL 467
   2. ANSI C-1 1978

PART 2 PRODUCTS

2.1 GENERAL

A. Furnish and install an electrical grounding system as indicated on the construction documents and as specified herein.

B. Grounding systems shall be installed in accordance with the requirements of the local authorities, NEC Section 250, and subject to the approval of the Architect.

C. All ground wires and bonding jumpers shall be stranded copper installed in conduit. All ground wires shall be without joints and splices over its entire length.

2.2 GROUNDING SYSTEMS

A. The system neutral shall be grounded at the service entrance only, and kept isolated from grounding systems throughout the building.

B. Each system of continuous metallic piping and ductwork shall be grounded in accordance with the requirements of the NEC Section 250.

C. Metal conduits and portions of metallic piping and duct systems which are isolated by flexible connections, insulated coupling, etc., shall be bonded to the equipment ground with a flexible bonding jumper, or separate grounding conductor.
D. All conduits, metal raceways, boxes, cabinets, etc., installed by this Contractor and all motors and equipment connected shall be properly bonded and grounded.

E. In all feeders and branch circuits install a green colored ground wire to each panel, cabinet, receptacle, motor or a piece of control equipment.

F. The green ground wires shall be extended and connected to the ground bus in the panels or equipment enclosure. Neutral wiring system shall not be used for this purpose. Green ground wire shall be connected to all junction or pull boxes through which they pass and to all cabinet and panel enclosures.

G. This ground wire shall be run in same conduit as phase and neutral wires feeding equipment, motor or receptacles and conduit size shall be increased if necessary. This conductor shall be installed whether or not shown on the drawings and shall be sized in accordance with NEC but shall not be smaller than #12 AWG. Motors shall be grounded by a grounding terminal in their connection box. Tie all ground wires together in panels and connect to ground bus in panel cabinet.

H. All electrical equipment including lighting fixtures shall be grounded in the same manner as motors. All equipment shall be solidly grounded to the green covered wire and this Contractor shall furnish grounding lugs as required.

PART 3 EXECUTION

3.1 GENERAL

A. Grounding connections and splices shall be brazed molded exothermic welded, bolted clamp terminal or pressure-connector type. Bolted connections and pressure-connectors shall be used for connections to removable equipment. Brazed connections shall be made where noted on drawings.

END OF SECTION
SECTION 26 05 29 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1  GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 1 Specification Section, apply to this Section.

1.2 SUMMARY

A. Equipment shall be installed on hangers and supports as specified in this section of the specifications.

1.3 SUPPORTS

A. Support work in accordance with the best industry practice and the following.

B. Include supporting frames or racks extending from floor slab to ceiling slab for work indicated as being supported from walls where the walls are incapable of supporting the weight. In particular, provide such frames or racks in electric closets.

C. Include supporting frames or racks for equipment, intended for vertical surface mounting, which is required in a free-standing position.

D. Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members. They shall be rigidly bolted or welded together and adequately braced to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of all equipment mounted on them.

E. Nothing, (including outlet, pull and junction boxes and fittings) shall depend on electric conduits, raceways, or cables for support, except that threaded hub type fittings having a gross volume not in excess of 100 cubic inches may be supported from heavy wall conduit, where the conduit in turn is securely supported from the structure within five inches of the fitting on two opposite sides.

F. Nothing shall rest on, or depend for support on, suspended ceilings media (tiles, lath, plaster, as well as splines, runners, bars and the like in the plane of the ceiling).

G. Provide required supports and hangers for conduit, equipment, etc., so that loading will not exceed allowable loadings of structure.

1.4 FASTENINGS

A. Fasten electric work to building structure in accordance with the best industry
practice and the following:

B. As a minimum procedure, where weight applied to the attachment points is 100 pounds or less, fasten to building elements of:
   1. Wood – with wood screws.
   2. Concrete and solid masonry – with bolts and expansion shields.
   4. Solid metal – with machine screws in tapped holes or with welded studs.
   5. Steel decking or subfloor – with fastenings as specified below for applied weights in excess of 100 pounds.

C. As a minimum procedure, where weight applied to the attachment points exceeds 100 pounds, but is 300 pounds or less, conform to the following:
   1. At concrete slabs utilize 24" x 24" x 1/2" steel fishplates on top with through bolts. Fishplate assemblies shall be chased in and grouted flush with the top of slab screen line, where no fill is to be applied.
   2. At steel decking or subfloor for all fastenings, utilize through bolts or threaded rods. The tops of bolts or rods shall be set at least one inch below the top fill screen line and grouted in. Suitable washers shall be used under bolt heads or nuts. In cases where the decking or subfloor manufacturer produces specialty hangers to work with his decking or subfloor such hangers shall be utilized.

D. Where weight applied to building attachments points exceeds 300 pounds, coordinate with and obtain approval of Architect and conform to the following:
   1. Utilize suitable auxiliary channel or angle iron bridging between building structural steel elements to establish fastening points. Bridging members shall be suitably welded or clamped to building steel. Utilize threaded rods or bolts to attach to bridging members.

E. Floor mounted equipment shall not be held in place solely by its own dead weight. Include floor anchor fastenings in all cases.

F. For items which are shown as being ceiling mounted at locations where fastening to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging tying to the building structural elements.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION
SECTION 26 05 33 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1  GENERAL

1.1 DESCRIPTION

A. General: Provide raceways in accordance with the Contract Documents.

1.2 STANDARDS

A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:

1. Rigid Conduit – RMC
   a. UL Standard UL-6
   b. ANSI C80-1
   c. Federal Specification WW-C-581E

2. Electrical Metallic Tubing – EMT
   a. UL Standard UL-797
   b. ANSI C80-3
   c. Federal Specification WW-C-563

3. Flexible Metal Conduit – FMC
   a. UL Standard UL-1

4. LiquidTight Flexible Metal Conduit – LFMC
   a. UL Standard UL-360

5. Rigid Non-Metallic Conduit – RNC
   a. UL Standard UL-651
   b. ANSI Standard C33.91
   c. Federal Specifications GSA-FSS and W-C1094-A

6. Wireways and Auxiliary Gutters
   a. UL Standard UL-870

7. Metal Clad Cable – MC
   a. UL Standard 1581
   b. Federal Spec J-C-30B

PART 2  PRODUCTS

2.1 RACEWAY TYPES

A. Rigid Steel Conduit – RMC
   1. Rigid steel conduit heavy wall galvanized.

B. Electric Metallic Tubing – EMT
   1. Continuous, seamless tubing galvanized or sheradized on the exterior coated on the interior with a smooth hard finish of lacquer, varnish or enamel.
2. All couplings, connectors, etc., used in conjunction with this raceway which are 2 inch in size and smaller shall be watertight compression type. EMT fittings shall be zinc plated steel. With conduits of 2-1/2 inch in size and larger, set screw type couplings are permitted.

C. Flexible Metal Conduit – FMC
1. Single strip, continuous, flexible interlocked double-wrapped steel, galvanized inside and outside forming smooth internal wiring channel.
3. Each section of raceway must contain a bonding wire bonded at each end and sized as required. Provide connectors with insulating bushings.

D. LiquidTight Flexible Metal Conduit – LFMC
1. Same as flexible steel conduit except with tough, inert watertight plastic outer jacket.
2. Cast malleable iron body and gland nut cadmium plated with one-piece brass grounding bushings which thread to interior of conduit. Spiral molded vinyl sealing ring between gland nut and busing and nylon insulated throat.

E. Metal Clad Cable – MC
1. Type MC cable shall be armored galvanized steel sheath cable with copper conductors and THHN 90 ° insulation. Furnish with insulated grounding conductor.

2.2 OUTLET, JUNCTION AND PULLBOXES

A. Provide zinc-coated or cadmium-plated sheet steel outlet boxes not less than 4 inches octagonal or square, unless otherwise noted. Equip fixture outlet boxes with 3/8 inch no-bolt fixture studs where required. Where fixtures are mounted on or in an accessible type ceiling, provide a junction box and extend flexible conduit to each fixture. Fit outlet boxes in finished ceilings or walls with appropriate covers, set flush with the finished surface. Where more than one switch or device is located at one point, use gang boxes and covers unless otherwise indicated. Sectional switch boxes or utility boxes will not be permitted. Provide Series "GW" (Steel City) tile box, or as accepted, or a 4 inch square box with tile ring in masonry walls which will not be plastered or furred. Where drywall material is utilized, provide plaster ring. Provide outlet boxes of the type and size suitable for the specific application. Where outlet boxes contain two or more 277 volt devices, or where devices occur of different applied voltages, or where normal and emergency devices occur in same box, provide suitable barrier.

B. Construct junction or pullboxes not over 150 cubic inches in size as standard outlet boxes, and those over 150 cubic inches the same as "cabinets" with screw covers of the same gauge metal.

C. Plug any open knockouts not utilized.
D. Provide surface mounted outlet and junction boxes in indoor locations where exposed to moisture and outdoor locations of cast metal with threaded hubs.

PART 3 EXECUTION

3.1 APPLICATION OF RACEWAYS

A. The following applications must be adhered to except as otherwise required by Code. Raceway not conforming to this listing must be removed by this Contractor and replaced with the specified material at this Contractor's expense.

B. Raceway Types

<table>
<thead>
<tr>
<th>Raceway Type</th>
<th>Application</th>
</tr>
</thead>
</table>
| Rigid Conduit RMC            | 1. Where exposed on outside of building or subjected to exterior temperatures and humidity.  
|                              | 2. Where required by codes.                                                   |
|                              | 3. All circuits in excess of 600V.                                           |
| Electrical Metallic Tubing EMT| Use in every instance except where another material is specified.             |
| Flexible Metal Conduit – FMC  | Use in dry areas for connections to lighting fixtures in hung ceilings, connections to equipment installed in removable panels of hung ceilings at all transformer or equipment raceway connections where sound and vibration isolation is required. |
| LiquidTight Flexible Metal Conduit - LFMC | Use in areas subject to moisture where flexible steel is unacceptable at connections to all motors, and all raised floor areas. |
| Metal-Clad Cable - MC        | Use for branch circuit wiring above suspended ceilings or in metal stud walls. Cable shall not be run exposed. Home run wiring from panelboard to first outlet box shall be installed in conduit. MC cable not permitted for fire alarm wiring systems or emergency lighting. |

3.2 RACEWAY SYSTEMS IN GENERAL

A. Provide raceways for all wiring systems unless noted otherwise. 277/480 volt wiring must be kept independent of 120/208 volt wiring. Where non-metallic raceways are utilized, provide sizes as required with the grounding conductor considered as an insulated additional conductor. Minimum size 3/4 inch for home runs and 1 inch minimum for power distribution. Wiring of each type and system must be installed in separate raceways.
B. Install capped bushings on raceways as soon as installed and remove only when wires are pulled. Securely tie embedded raceway in place prior to embedment. Raceways installed below or in floor slabs must extend a minimum of 4 inches above the finished slab to the first connector. Lay out the work in advance to avoid excessive concentrations or multiple raceway runs.

C. Locate raceways so that the strength of structural members is unaffected and they do not conflict with the services of other trades. Install 1 inch or larger raceways in or through structural members (beams, slabs, etc.) only when and in the manner accepted by the Architect. Draw up couplings and fittings full and tight. Protect threads from corrosion with one coat zinc chromate after installation.

D. Above Grade – Defined as the area above finished grade for a building exterior and above top surface of any slabs (or other concrete work) on grade for a building interior. Above-grade raceways to comply with the following:

1. Install raceways concealed except at surface cabinets and for motor and equipment connection in electrical and mechanical rooms. Install a minimum of 6 inches from flues, steam pipes, or other heated lines. Provide flashing and counter-flashing for waterproofing of raceways, outlets, fittings, etc., which penetrate the roof. Route raceways parallel or perpendicular to building lines with right-angle turns and symmetrical bends. Run embedded raceways in a direct line and, where possible, with long sweep bends and offsets. Provide sleeves in forms for new concrete walls, floor slabs and partitions for passage of raceways. Waterproof sleeved raceways where required.

2. Provide raceway expansion joints for exposed and concealed raceways with necessary bonding conductor at building expansion joints and between buildings or structures and where required to compensate for raceway or building thermal expansion and contraction.

3. Provide one empty 3/4 inch raceway for each three spare unused poles or spaces of each flush-mounted panelboard. Terminate empty 3/4 inch conduit in a junction box, which after completion, is accessible to facilitate future branch circuit extension.

4. Provide raceway installation (with appropriate seal-offs, explosion-proof fittings, etc.) in special occupancy area, as required. Provide conduit seal-offs where portions of an interior raceway system pass through walls, ceiling or floors which separate adjacent rooms having substantially different maintained temperatures, as in refrigeration or cold storage rooms.

5. Protect raceway in earth or fill with two coats of asphalt base paint. Touch up abrasions and wrench marks after conduit is in place.

6. In lieu of above, protect raceways with a minimum of 20 mil tape approved for the purpose and overlapped a minimum of 1/2 tape width.

7. Provide drag wire in spare or empty raceways. Tag both ends of wire denoting opposite and termination location with black India ink on flameproof linen tag.
E. Raceways in hung ceilings shall be run on and secured to slab or primary structural members of ceiling, not to lathing channels or T-bars or other elements which are the direct supports of the ceiling panels. Secure conduit firmly to steel by clips and fittings designed for that purpose. Install as high as possible, but not less than, 1-0" above hung ceilings.

F. Exposed raceways shall be run parallel or at right angles with building lines. Secure raceway clamps or supports to masonry materials by toggle bolts, expansion bolts, or steel inserts. Install raceway on steel construction with approved clamps which do not depend on friction or set-screw pressure alone.

G. Clear raceway of all obstructions and dirt prior to pulling in wires or cables. This shall be done with ball mandrel (diameter approximately 85% of conduit inside diameter) followed by close fitting wire brush and wad of felt or similar material. This assembly may be pulled in together with, but ahead of the cable being installed. All empty raceways shall be similarly cleaned. Clear any raceway which rejects ball mandrel.

H. Support less than 2 inch trade size, vertically run, raceways at intervals no greater than eight feet. Support such raceways, 2 inch trade size or larger, at intervals no greater than 10 feet.

I. Support less than 1 inch trade size horizontally run, raceways at intervals not greater than 7 feet. Support such raceways, 1 inch trade size or larger, at intervals no greater than 10 feet.

3.3 OUTLET, JUNCTION, AND PULLBOXES

A. Provide outlet, junction, and pullboxes as indicated on the Drawings and as required for the complete installation of the various electrical systems, and to facilitate proper pulling of wires and cables. J-boxes and pullboxes shall be sized per NEC minimum.

B. The exact location of outlets and equipment is governed by structural conditions and obstructions or other equipment items. When necessary, relocate outlets so that when fixtures or equipment are installed, they will be symmetrically located according to the room layout and will not interfere with other work or equipment. Verify final location of outlets, panels equipment, etc., with Architect.

C. Back-to-back outlets in the same wall or "thru-wall" type boxes are not permitted. Provide 12 inch (minimum) spacing for outlets shown on opposite sides of a common wall to minimize sound transmission.

END OF SECTION
PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Condition and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Identification for electrical raceways
   2. Identification of power and control cables
   3. Identification for branch circuit and feeder conductors
   4. Underground-line warning tape
   5. Warning labels and signs per N.E.C.
   6. Instruction signs
   7. Identification labels for distribution equipment, junction boxes, cabinets and miscellaneous equipment.

1.3 SUBMITTALS

A. Product Data: Furnish type of material to be supplied for each electrical identification product indicated.

1.4 STANDARDS

A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
   1. Comply with ANSI A13.1
   2. Comply with NFPA 70
   4. Comply with ANSI Z535.4 for safety signs and labels

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors and features with requirements in the Contract Documents, shop drawings, manufacturer's wiring diagrams and operation and manual and with those required by codes and standards.

PART 2 PRODUCTS

2.1 POWER RACEWAY AND METAL CLAD CABLE IDENTIFICATION MATERIALS
A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Raceway Colors for Circuits at 600 V or Less
   1. Black letters on an orange field.
   3. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, Bright-Colored, Continuous-Printed, Polyethylene Tape
   1. Not less than 6 inches wide by 4 mils thick.
   2. Compounded for permanent direct-burial service.
   3. Embedded continuous metallic strip or core.
   4. Printed legend shall indicate type of underground line.

2.4 WARNING LABELS AND SIGNS


B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Warning label and sign shall include, but are not limited to, the following legends:
   1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
   2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.5 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs
up to 20 sq. inches and 1/8 inch thick for larger sizes.
1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 EQUIPMENT IDENTIFICATION LABELS


2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 EXECUTION

3.1 INSTALLATION

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 90A: Identify with orange self-adhesive vinyl label.

B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands.
   1. Fire Alarm System: Red
   2. Fire-Suppression Supervisory and Control System: Red and Yellow
   3. Combined Fire Alarm and Security System: Red and Blue
   4. Security System: Blue and Yellow
   5. Mechanical and Electrical Supervisory System: Green and Blue
   6. Telecommunication System: Green and Yellow
   7. Control Wiring: Green and Red

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous
underground-line warning tape directly above line at 12 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
   1. Emergency Power
   2. Power
   3. Lighting

B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
   1. Color-Coding for Phase Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
      a. Colors for 208/120-V Circuits
         1) Phase A: Black
         2) Phase B: Red
         3) Phase C: Blue
         4) Neutral: White
         5) Ground: Green
      b. Colors for 480/277-V Circuits
         1) Phase A: Brown
         2) Phase B: Orange
         3) Phase C: Yellow
         4) Neutral: White
         5) Ground: Green
      c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

C. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

   1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
   2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
E. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
   1. Limit use of underground-line warning tape to direct-buried cables.
   2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

F. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install marking tape at flush-mounted panelboards and similar equipment in finished spaces.

G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
   2. Identify system voltage with black letters on an orange background.
   3. Apply to exterior of door, cover, or other access.
   4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
      a. Power transfer switches.
      b. Controls with external control power connections.

H. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

I. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
   1. Labeling Instructions
      a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide five lines of text.
         1) First Line: 1/2-inch letters on the first line stating equipment name.
         2) Second Line (if applicable): 3/8-inch letters stating the existing equipment name in parentheses ( ).
         4) Fourth Line: 3/8-inch letters stating the breaker number, panel name and room number/name (Owner's room number) from which the equipment is fed.
         5) Fifth Line: 3/8-inch letters stating function and/or equipment which it controls.
2. Equipment to be Labeled
   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
   e. Emergency system boxes and enclosures.
   f. Enclosed switches.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Distributed Digital Lighting Control System: System includes
   1. Digital Lighting and Plug Load Controls
   2. Relay Panels

1.2 REFERENCES

B. NEMA - National Electrical Manufacturers Association
C. FCC emission standards
D. UL - Underwriters Laboratories, Inc. Listings
F. UL 20 - General Use Switches, Plug Load Controls
G. UL 924 - Standard for Emergency Lighting and Power Equipment
H. ULC - Underwriter Laboratories of Canada Listings

1.3 DESIGN / PERFORMANCE REQUIREMENTS

A. Digital Lighting Management System shall accommodate the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories that suit the required lighting and electrical system parameters.
B. System shall conform to requirements of NFPA 70.
C. System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and residential application.
D. System shall be listed under UL sections 916 and/or 508.

1.4 SUBMITTALS
A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Catalog sheets and specifications.
   2. Ratings, configurations, standard wiring diagrams, dimensions, colors, service
      condition requirements, and installed features.
   3. Storage and handling requirements and recommendations.
   4. Installation instructions.

C. Shop Drawings: Wiring diagrams for the various components of the System
   specified including:
   1. Composite wiring and/or schematic diagram of each control circuit as
      proposed to be installed.
   2. Show location of all devices, including at minimum sensors, load controllers,
      and switches/dimmers for each area on reflected ceiling plans.
   3. Provide room/area details including products and sequence of operation for
      each room or area. Illustrate typical acceptable room/area connection
      topologies.
   4. Network riser diagram including floor and building level details. Include
      network cable specification. Illustrate points of connection to integrated
      systems. Coordinate integration with mechanical and/or other trades.

D. Manufacturer's Certificates: Certify products meet or exceed specified
   requirements.

E. Closeout Submittals:
   1. Project Record Documents: Record actual installed locations and settings for
      lighting control devices.
   2. Operation and Maintenance Manual:
      a. Include approved Shop Drawings and Product Data.
      b. Include Sequence of Operation, identifying operation for each room or
         space.
      c. Include manufacturer's maintenance information.
      d. Operation and Maintenance Data: Include detailed information on
         device programming and setup.
      e. Include startup and test reports.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing of centralized
   and distributed lighting control systems with a minimum of 10 years documented
   experience.

B. Installer Qualifications: Company certified by the manufacturer and specializing in
   installation of networked lighting control products with minimum three years
   documented experience.
C. System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.

1.6 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to commencing Work of this section. Meeting to be attended by Contractor, Architect, system installer, factory authorized manufacturer's representative, and representative of all trades related to the system installation.

B. Review installation procedures and coordination required with related Work and the following:
   1. Confirm the location and mounting of all devices, with special attention to placement of switches, dimmers, and any sensors.
   2. Review the specifications for low voltage control wiring and termination.
   3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
   4. Discuss requirements for integration with other trades

C. Inspect and make notes of job conditions prior to installation:
   1. Record minutes of the conference and provide copies to all parties present.
   2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
   3. Installation shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
   1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).
   2. Relative humidity: Maximum 90 percent, non-condensing.

1.9 WARRANTY
A. Products Warranty: Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Legrand Wattstopper, equivalent by Crestron shall be acceptable for this project.

2.2 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

A. System General: Provide a Legrand Wattstopper, Provide Digital Lighting Management System (DLM) complete with all necessary enclosures, wiring, and system components to ensure a complete and properly functioning system as indicated on the Drawings and specified herein. If a conflict is identified, between the Drawing and this Specification, contact the Architect for clarification prior to proceeding.

1. Space Control Requirements: Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality as indicated in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.

B. Equipment Required: Lighting Control and Automation system as defined under this section covers the following equipment.

1. Digital Lighting Management (DLM) local network: Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
2. Digital Switches: Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
3. Digital Lighting Management Relay Panel and Zone Controller: Provides up to 8, 24, or 48 mechanically latching relays. Relays include a manual override and a single push-on connector for easy installation or removal from the panel. Panel accepts program changes from handheld configuration tool for date and time, location, holidays, event scheduling, button binding and group programming. Provides BACnet MS/TP-compliant digital networked communication between other lighting controls and/or building automation system (BAS). Zero relay Zone Controller primarily supports Digital Fixture Controller applications.
C. Local Network LMRJ-Series: DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.

1. Features of the DLM local network include:
   a. Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
   b. Simple replacement of any device in the local DLM network with a standard off the shelf unit without requiring significant commissioning, configuration or setup.
   c. Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
   d. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

2. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.

3. If manufacturer's pre-terminated Cat5e cables are not used for the installation each cable must be individually tested and observed by authorized service representative following installation.

2.3 DIGITAL WALL SWITCHES

A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:

1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
3. Configuration LED on each switch that blinks to indicate data transmission.
4. Load/Scene Status LED on each switch button with the following characteristics:
   a. Bi-level LED
   b. Dim locator level indicates power to switch
   c. Bright status level indicates that load or scene is active
   d. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.

5. Programmable control functionality including:
   a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.

6. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:
   1. Button state
   2. Switch lock control
   3. Switch lock status

C. Two RJ-45 ports for connection to DLM local network.

D. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.

E. Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.
   1. Individual button function may be configured to Toggle, On only or Off only.
   2. Individual scenes may be locked to prevent unauthorized change.
   3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
   4. Ramp rate may be adjusted for each dimmer switch.
   5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.

2.4 LMCP LIGHTING CONTROL PANELS AND LMZC ZONE CONTROLLER

A. Hardware: Provide LMCP lighting control panels in the locations and capacities as indicated on the Drawing and schedules. Each panel shall be of modular construction and consist of the following components:
   1. Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8 relays, 1 - 24 relays and 6 four-pole contactors, or 1 - 48 relays and 6 four-pole contactors.
   2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. LMCP panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
   3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. Interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. Interior assembly shall include
intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. Panel interiors shall include the following features:

a. Removable, plug-in terminal blocks with connections for all low voltage terminations.
b. Individual terminal block, override pushbutton, and LED status light for each relay.
c. Direct wired switch inputs associated with each relay shall support 2-wire momentary switches only.
d. Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches; digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs; digital IO modules capable of receiving momentary or maintained contact closure inputs or analog sensor inputs; digital daylighting sensors; and digital occupancy sensors. Inputs are divided into two separate digital networks, each capable of supplying 250mA to connected devices.
e. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet.
f. Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously.
g. Group and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any set of relays can be associated with a group for direct on/off control or pattern (scene) control via a simple programming sequence using the relay override pushbuttons and LED displays for groups 1-8 or a handheld IR programmer for groups 1-99.
h. Relay group status for shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.

4. Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:

a. Electrical:
   1) 30 amp ballast at 277V
   2) 20 amp ballast at 347V
   3) 20amp tungsten at 120V
   4) 30 amp resistive at 347V
   5) 1.5 HP motor at 120V
   6) 14,000 amp short circuit current rating (SCCR) at 347V
   7) Relays shall be specifically UL 20 listed for control of plug-loads
b. Mechanical:
   1) Replaceable, 1/2 inch KO mounting with removable Class 2 wire harness.
   2) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.
3) Dual line and load terminals each support two #14 - #12 solid or stranded conductors.
4) Tested to 300,000 mechanical on/off cycles.
5) Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
6) Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.
7) Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic by pass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the requirements of UL924 and NFPA 70 - Article 700.
8) Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control.
   a. Each panel shall include digital clock capability able to issue system wide automation commands to up to 11 other panels for a total of 12 networked lighting control panels. Clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups.
   b. Clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes.
   c. Clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery back up for clock function and program retention in non-volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.
   d. Clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-configured control scenarios. Scenarios shall include:
      1) Scheduled ON / OFF
      2) Manual ON / Scheduled OFF
      3) Astro ON / OFF (or Photo ON / OFF)
      4) Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)
   e. User interface shall be a portable IR handheld remote control capable of programming any panel in the system (LMCT-100)
   f. Clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years.
   g. Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel in the event that global network communication is lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable.
9. Lighting control panel can operate as a stand-alone system, or can support schedule, group, and photocell control functions, as configured in a Segment Manager controller, via a segment network connection.

10. Lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet protocol.
   a. Panel shall have provision for an individual BACnet device ID and shall support the full 222 range (0 - 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.
   b. Panel shall support MS/TP MAC addresses in the range of 0 - 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.
   c. Lighting control relays shall be controllable as binary output objects in the instance range of 1 - 64. The state of each relay shall be readable and writable by the BAS via the object present value property.
   d. Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 - 64.
   e. The 99 group Normal Hours/After Hours control objects associated with the panel shall be represented by binary value objects in the instance range of 201 - 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hours mode. Commanding 0 or NULL shall put the relays into the after hours mode.
   f. Setup and commissioning of panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote. Provide BACnet objects for panel setup and control as follows:
      1) Binary output objects in the instance range of 1 - 64 (one per relay) for on/off control of relays.
      2) Binary value objects in the instance range of 1 - 99 (one per channel) for normal hours/after hours schedule control.
      3) Binary input objects in the instance range of 1 - 64 (one per relay) for reading true on/off state of the relays.
      4) Analog value objects in the instance range of 101 - 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warn feature for the channel and set a 5-minute grace-time period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches.
   g. Description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.
   h. BO and BV 1 - 99 objects shall support BACnet priority array with a relinquish default of off and after hours respectively. Prioritized writes
to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (http://www.bacnet.org/Addenda/Add-135-2010aa.pdf)

i. Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object.

j. Lockout of all digital switch buttons connected to a given panel shall be command-able via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196.

11. In addition to the LMCP Relay Panels, an LMZC Zone Controller panel shall be available for zero-relay applications. The panel is designed for applications where LMFC-011 Fixture Controllers or other distributed load controllers are used to switch and/or dim the controlled loads. Key similarities to and differences from the LMCP panel design shall include:
   a. Use the same intelligence board as the LMCP relay panel.
   b. Shall not include relay driver boards or relays.
   c. Have a removable interior section to facilitate installation, and a Tub/Cover. Cover is for surface mounting applications only.
   d. Tub shall have two interior KOs to allow installation of LMPB-100 Power Boosters. Each installed Power Booster can provide an additional 150 mA for either of the two available DLM local networks provided by the LMZC.
   e. All programming and networking (whether DLM Local Network and/or Segment Network) capabilities in the LMZC Zone Controller shall be similar to capabilities for LMCP relay panels, except for functions designed for panel-mounted HDR relays.

12. To aid in project start up, if LMFC Fixture Controllers are connected to an LMZC Zone Controller, Plug n’ Go automatic configuration will establish a unique sequence of operation so that all LMFC-controlled fixtures will turn on to 50 percent output when any digital occupancy sensor detects motion.


B. User Interface: Each lighting control panel system shall be supplied with at least one handheld configuration tool (LMCT-100). As a remote programming interface, the configuration tool shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. User interface shall have the following panel-specific functions as a minimum:
   1. Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.
   2. Relay Group creation of up to 99 groups. Group creation shall result in programming of all seven key relay parameters for member relays. The seven parameters are as follows: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.
3. Program up to 254 separate scheduled events. Events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays. Holidays are also defined through the User Interface.

4. Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays.

5. Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.

6. Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.

7. Legrand Wattstopper Product Number: LMCT-100

2.5 DIGITAL WALL SWITCH OCCUPANCY SENSORS

A. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:

1. Digital calibration and pushbutton configuration for the following variables:
   a. Sensitivity: 0-100 percent in 10 percent increments
   b. Time delay: 1-30 minutes in 1 minute increments
   c. Test mode: Five second time delay
   d. Detection technology: PIR, Dual Technology activation and/or re-activation.
   e. Walk-through mode
   f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.

2. Programmable control functionality including:
   a. Each sensor may be programmed to control specific loads within a local network.
   b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
   c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.
   d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
      1) Ultrasonic and Passive Infrared
      2) Ultrasonic or Passive Infrared
      3) Ultrasonic only
4) Passive Infrared only
3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
4. Two RJ-45 ports for connection to DLM local network.
5. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.
6. Device Status LEDs including
   a. PIR detection
   b. Ultrasonic detection
   c. Configuration mode
   d. Load binding
7. Assignment of any occupancy sensor to a specific load within the room without wiring or special tools.
8. Assignment of local buttons to specific loads within the room without wiring or special tools
9. Manual override of controlled loads
10. All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:
1. Detection state
2. Occupancy sensor time delay
3. Occupancy sensor sensitivity, PIR and Ultrasonic
4. Button state
5. Switch lock control
6. Switch lock status

C. Units shall not have any dip switches or potentiometers for field settings.

D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

E. Two-button wall switch occupancy sensors, when connected to a single relay dimming room or fixture controller, shall operate in the following sequence as a factory default:
1. Left button
   a. Press and release - Turn load on
   b. Press and hold - Raise dimming load
2. Right button
   a. Press and release - Turn load off
   b. Press and hold - Lower dimming load

F. Low voltage momentary pushbuttons shall include the following features:
1. Load/Scene Status LED on each switch button with the following characteristics:
   a. Bi-level LED
   b. Dim locator level indicates power to switch
   c. Bright status level indicates that load or scene is active
2. The following button attributes may be changed or selected using a wireless configuration tool:
   a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
   b. Individual button function may be configured to Toggle, On only or Off only.
   c. Individual scenes may be locked to prevent unauthorized change.
   d. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
   e. Ramp rate may be adjusted for each dimmer switch.
   f. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
   g. Wattstopper part numbers: LMPW, LMDW. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

PART 3 EXECUTION

3.1 PREPARATION

A. Do not begin installation until measurements have been verified and work areas have been properly prepared.

B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that required pre-installation meeting specified in Part 1 of this specification has been completed, recorded meeting minutes have been distributed and all outstanding issues noted have been resolved prior to the start of installation.

3.2 INSTALLATION

A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.

B. Install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors.
   1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the
Manufacturer's Representative for approval prior to proceeding with the Work.

2. If fixtures have internal DLM Control Modules, ensure that they are also connected with Cat 5e cable.

3. Install all room to room network devices using manufacturer-supplied LM-MSTP network wire or wireless devices. Network wire substitution is not permitted and may result in loss of product warranty.

4. Low voltage wiring topology must comply with manufacturer's specifications.

5. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.

C. All line voltage connections shall be tagged to indicate circuit and switched legs.

D. Test all devices to ensure proper communication.

E. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.

F. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
   1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
   2. Sequence of operation, (e.g. manual ON, Auto OFF, etc.)
   3. Load Parameters (e.g. blink warning, etc.)

G. Tighten all panel Class I conductors from both circuit breaker and to loads to torque ratings as marked on enclosure UL label.

H. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.

I. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.

J. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Architect and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.

B. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.
1. Verify Class I and II wiring connections are terminated properly by validating system performance.
2. Set IP addresses (if applicable) and other network settings of system front end hardware per facilities IT instructions.
3. Verify / complete task programming for all switches, dimmers, time clocks, and sensors.
4. Verify that the control of each space complies with the Sequence of Operation.
5. Correct any system issues and re-test.

C. Provide a report in table format with drawings or using a software file that can be opened in the manufacturer's system software including each room or space that has lighting control installed. Indicate the following:
1. Date of test or inspection.
2. Loads per space, or Fixture Address identification.
3. Quantity and Type of each device installed
4. Reports providing each device's settings.

3.4 PRODUCT SUPPORT AND SERVICE

A. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

END OF SECTION
PART 1  GENERAL

1.1 SCOPE

A. The Contractor shall furnish and install single-phase and three-phase general purpose individually mounted dry-type transformers of the two-windings type, self-cooled as specified herein, and as shown on the contract drawings.

1.2 REFERENCES

A. The transformers and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of ANSI, NEMA and UL.

B. Transformers shall meet the requirements of the most current version of federal law 10 CFR Part 431 "Energy Efficiency Program for Certain Commercial and Industrial Equipment".

1.3 SUBMITTALS – FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:
   1. Outline dimensions and weights
   2. Transformer ratings included:
      a. kVA
      b. Primary and secondary voltage
      c. Taps
      d. Basic impulse level (BIL) for equipment over 600 volts
      e. Design impedance
      f. Insulation class and temperature rise
      g. Sound level
   3. Product data sheets

1.4 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes.
   1. Final as-built drawings and information for items listed in Paragraph 1.3, and shall incorporate all changes made during the manufacturing process
   2. Connection diagrams
   3. Installation information

1.5 QUALIFICATIONS

A. The manufacturer of the dry-type distribution transformers shall be the same as the manufacturer of the other major electrical distribution equipment on the project.
B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer shall be a participant in the UL Data Acceptance Program (DAP) under the Client Test Data Program (CTDP) certification to ensure UL test methodologies and record traceability complies with the requirements of ISO 17025.

D. Transformer must bear the UL Energy Efficiency Verification Mark to confirm that the unit meets the requirements of 10 CFR Part 431.

E. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years.

1.6 REGULATORY REQUIREMENTS

A. All transformers shall be UL listed and bear the UL label.

1.7 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.8 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Eaton/Cutler-Hammer products

B. Square D

C. General Electric

D. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

2.2 RATINGS

A. The kVA and voltage ratings shall be as indicated on the Drawings.
B. Transformers shall be designed for continuous operation at rated kVA, for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSI C57.96.

C. Transformer shall meet the requirements of the most current version of federal law 10 CFR Part 431 "Energy Efficiency Program for Certain Commercial and Industrial Equipment".

D. Transformers efficiency shall be measured according to federal law 10 CFR Part 431.

E. Transformer sound levels shall not exceed the following ANSI and NEMA levels for self-cooled ratings:

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<th>Equivalent Winding kVA Range</th>
<th>K-Factor = 1</th>
<th>K-Factor = 4</th>
<th>K-Factor = 9</th>
<th>K-Factor = 13</th>
<th>K-Factor = 20</th>
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2.3 CONSTRUCTION – GENERAL PURPOSE TRANSFORMERS

A. Insulation Systems
   1. Transformer insulation system shall be as follows:
      a. Less than 15 kVA: 180 degrees C insulation system with 115 degree C rise, encapsulated design; 15 kVA and above: minimum of 200 degree C insulation system with 80 115 degree C rise, ventilated design.
   2. Required performance shall be obtained without exceeding the above indicated temperature rise in a 40 degrees C maximum ambient, and a 24-hour average ambient of 30 degrees C.
   3. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM Standard Test Method D635.
B. Core and Coil Assemblies
1. Transformer core shall be constructed with high-grade, non-aging, silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be substantially below the saturation point. The transformer core volume shall allow efficient transformer operation at 10% above the nominal tap voltage. The core laminations shall be tightly clamped and compressed. Coils shall be wound of electrical grade copper with continuous wound construction.
2. On single-phase and three-phase units rated 15 kVA and the core and coil assembly shall be completely encapsulated in a proportioned mixture of epoxy or resin and aggregate to provide a moisture proof, shock-resistant seal. The core and coil encapsulation system shall minimize the sound level.
3. On single-phase and three-phase units rated 15 kVA and above the coils assembly shall be impregnated with non-hydroscopic, thermosetting varnish and cured to reduce hot spots and seal out moisture; the core shall be coated with HAPs (Hazardous Air Pollutants) free water reducible electrical varnish to give good corrosion resistance. The assembly shall be installed on vibration-absorbing pads.
4. Terminals shall be welded to the leads of the coils for better conductivity, less maintenance, and lower risk of hot spots. Terminals shall not be spot welded or bolted to the coil leads.

C. Taps
1. Three-phase transformers rated 15 through 300 kVA shall be provided with six 2-1/2% taps, two above and four below rated primary voltage. Three-phase transformers rated greater than 300 kVA shall be provided with manufacturer’s standard taps for that rating.
2. All single-phase transformers, and three-phase transformers rated below 15 kVA and above 500 kVA, shall be provided with the manufacturer’s standard tap configuration.

D. Electrostatic Shielding
1. Provide shielded isolation transformers with an electrostatic shield consisting of a single turn of aluminum placed between the primary and secondary winding and grounded to the housing of the transformer.
   a. Electrostatic shield shall provide primary to secondary winding capacitance between 24 and 18 picofarads over the range of 100 Hz to 20 kHz.

2.4 WIRING/TERMINATIONS

A. Recommended external cable shall be rated 90 degrees C sized at 75 degrees C ampacity) for encapsulated and 75 degrees C for ventilated designs. Connectors should be selected on the basis of the type and cable size used to wire the specific transformer.
2.5 ENCLOSURE

A. The enclosure shall be made of heavy-gauge steel. All transformers shall be equipped with a wiring compartment suitable for conduit entry and large enough to allow convenient wiring. The maximum temperature of the enclosure shall not exceed 90 degrees C. The core of the transformer shall be grounded to the enclosure.

B. On three-phase units rated 15 kVA and below and single-phase units rated 15 kVA and below the enclosure construction shall be encapsulated, totally enclosed, non-ventilated, NEMA 3R, with lifting provisions.

C. On three-phase units rated 15 kVA and above and single-phase units rated 15 kVA and above the enclosure construction shall be ventilated, NEMA 2, drip-proof, with lifting provisions. All ventilation openings shall be protected against falling dirt. On outdoor units, provide weathershields over ventilated openings.

D. Ventilated type transformers that meet 10 CFR Part 431 efficiency requirements, with a core size of 150 kVA or less, shall be suitable for installation with 2-inch clearance from a wall or other obstruction behind the transformer enclosure.

2.6 FINISH

A. Steel enclosures shall be finished with ANSI 61 color, weather-resistant enamel.

PART 3 EXECUTION

3.1 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.
1. Ratio tests at the rated voltage connection and at all tap connections.
2. Polarity and phase relation tests on the rated voltage connection.
3. Applied potential tests.
4. Induced potential test.
5. No-load and excitation current at rated voltage on the rated voltage connection.

3.2 INSTALLATION

A. Transformers shall be floor mounted except where indicated on the Drawings to be suspended or wall mounted.

B. Suspended transformers shall be mounted on hanger rods with a spring isolator in each rod.
C. Floor mounted transformers shall be mounted on 4 inch high concrete housekeeping pads. Provide neoprene pads between transformer legs and housekeeping pad and anchor transformer to floor.

D. Provide grounding electrode conductor from transformer secondary neutral to nearest effectively grounded building structural steel.

E. Conduit connected to transformers shall be flexible metal conduit, 24 inches minimum length, 60 inches maximum length.

3.3 FIELD ADJUSTMENTS

A. Adjust taps to deliver appropriate secondary voltage.

3.4 FIELD TESTING

A. Measure primary and secondary voltages for proper tap settings.

END OF SECTION
PART 1  GENERAL

1.1  DESCRIPTION

A. General: Provide panelboards in accordance with the Contract Documents.

1.2  STANDARDS

A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
   1. Panelboards
      a. UL Standards #67.
      b. UL Standard 50 Cabinet and Boxes
      d. NEMA Standard PB-1
      e. Circuit Breakers – Type 1, Class 1.

1.3  SUBMITTALS

A. Submittals will be furnished. Submittals failing to meet the following criteria will be returned without a review or acceptance.

B. With each panelboard drawing the following is required:
   1. Show main devices and lug sizes; branch circuit device sizes and arrangement; bus ampacities; withstandability and short circuit rating; dimensions and construction; gutter and backbox dimensions; nameplate and legend; protective coating; and all pertinent details of panel, enclosure, cover, and method of securing cover and lock.

1.4  QUALITY ASSURANCE

A. Each panelboard as a complete and finished product shall receive a single integrated equipment rating by the manufacturer. The integrated equipment short circuit wiring shall certify that all equipment is capable of withstanding the thermal and magnetic stress of a fault equal to the value specified on the Drawings. Such rating shall be established by actual tests by the manufacturer on similar equipment. This certification shall be permanently affixed to each panelboard. Test data shall be submitted to the Engineer at time of submission of Acceptance Drawings.

PART 2  PRODUCTS

2.1  APPROVED MANUFACTURERS
A. Eaton
B. Square D
C. General Electric
D. Siemens

E. 277/480 volts circuit breaker type panelboards are to be equal to Eaton Pow-R – Line 2.
F. 120/208 volts circuit breaker type panelboards are to be equal to Eaton Pow-R Line 1.
G. Breaker distribution panelboards are to be equal to Eaton Pow-R-Line-4B.

2.2 PANELBOARDS IN GENERAL

A. Provide panelboards consisting of an assembly of branch circuit switching and protective devices (circuit breakers, switch and fuse units, or combination thereof) mounted inside a dead front enclosure. Provide the number and size of these branch circuit devices as indicated by the circuiting, on the drawings, and in the schedules.

B. Interiors
   1. Rigid removable assembly of copper bus bars and interchangeable bolted branch circuit devices.
   2. Bus bars drilled to permit branch circuit devices of all sizes and number of poles to be interchangeable and installed in any spare space of sufficient size, without disturbing adjacent units; without removing main bus or branch circuit connectors and without machining, drilling, or tapping in the field.
   3. Arrange bus in sequence or distributed phasing so that multipole circuit breaker can replace any group of single circuit breakers of the same size.
   4. Provide copper neutral bus in each panelboard.
   5. Provide copper ground bus in each panelboard.

C. Enclosure
   2. Provide a bolt-on ground connector to inside of enclosure.
   3. Flush mounted in finished areas and where indicated. Surface mount elsewhere.

D. Front
   1. Doors must be provided on all lighting and power distribution panels. On switch and fuse panelboards, doors for overcurrent devices are not to be provided.
   2. Heavy code gauge steel as required to maintain panel face flat.
3. Hold front closed with trim clamps.
4. Factory finished in medium gray enamel or two coats of air-drying lacquer over a rust inhibitor.
5. Provide directory for total number of poles.
6. Provide approved lock. All panels keyed alike. Furnish 4 sets of matching keys to the Owner.
7. Welded angle rest at the bottom of the door to facilitate cover installation.
8. Doors over 48" in height shall have auxiliary fasteners at top and bottom of door in addition to lock and catch.

E. Terminal lugs
1. Bolted type, labeled for either copper or aluminum conductors.
2. Locate main lugs properly at top or bottom, depending where main feeder enters.

F. Electrical Ratings
1. Panelboards are to be rated 120/208 or 277/480 volts 3 phase, 4 wire, full neutral with ampacities as indicated on the Drawings (unless otherwise noted).
2. Short circuit withstand ratings shall be as indicated on the Drawings. Panelboards shall be fully rated. Series rated not acceptable.
3. Where indicated, provide panelboards having a "service entrance" Type UL label with neutrals factory bonded to frame or enclosure.

G. Circuit Breaker Devices
3. Silver alloy contacts with auxiliary arc-quenching devices.
4. Panelboard must be of the type which will accept the field installation of shunt trip devices of 60 amperes or less on the branch devices.
5. Interrupting capacities shall be as indicated on the Drawings. In general, 120/208 volt devices shall be not less than (10,000 AIC). And 277/480 not less than (14,000 AIC).
6. Arc Fault Circuit Breaker Devices shall be equipped with 5mA ground fault protection integrated design capability. Provide arc fault breakers (AFCI) for all bedroom lighting and power 15-ampere and 20-ampere single pole 120Volt circuits indicated on the plans.
7. For lighting circuits that are controlled at panel, provide devices labeled "SWD" for switching purposes.
8. Bolted type terminals UL listed for either aluminum or copper 75 degrees C cables.
9. Provide main breakers in panels served from transformers.
10. Locate next to each breaker or space unit an individual number.
11. Circuit breakers serving kitchen equipment beneath cooking hoods shall include a shunt trip coil.
12. Panelboard shall accept circuit breakers from 15 ampere to 100 ampere.

2.3 DISTRIBUTION PANELBOARDS

A. Distribution panelboards with bolt-on devices shall have interrupting ratings as specified herein or indicated on the drawings. Panelboards shall be fully rated. Panelboards shall be Eaton type Pow-R-Line 4B.

B. Where indicated, provide circuit breakers UL listed for application at [80%] [100%] of their continuous ampere rating in their intended enclosure.

C. Trip Units for Molded Case Circuit Breakers – 1200 A and Below
1. Protective devices shall be molded case circuit breakers with inverse time and instantaneous tripping characteristics and shall be Eaton or approved equal.
2. Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be nonwelding silver alloy and arc extinction shall be accomplished by means of DE-ION arc chutes. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.
3. Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the drawings.
4. Circuit breakers 225-ampere frame and below shall have thermal-magnetic trip units and inverse time-current characteristics.
5. Circuit breakers 250-ampere through 1200-ampere frame shall have microprocessor-based rms sensing trip units.
6. Ground fault protection shall be provided where indicated.

D. Enclosure
1. Enclosures shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.
2. Enclosures shall be provided with blank ends.

E. Nameplates
1. Provide an engraved nameplate for each panel section.

PART 3 EXECUTION

3.1 INSTALLATION
A. Mount panel 4 feet to panel center but with maximum height of 6 feet 6 inches to handle of topmost switching device.

B. Mount surface type panels a minimum of 1 inch off wall on channels.

C. Connect feed-through panels to main feeder by insulated parallel gutter taps. Full-size tap for two panels on a common feeder. Increase cabinet width to accommodate gutter tap.

D. Where flush mounted, the fire integrity of the wall in which it is installed must be maintained.

E. Neatly arrange branch circuit wires and tie together in each gutter with Thomas & Betts nylon "Ty-Raps", or approved equal at minimum 4 inch intervals.

F. Plug all knockouts removed and not utilized.

3.2 TOUCH UP AND CLEANING

A. Vacuum all backboxes clean of debris after installation and prior to final payment.

B. Touch up scratch marks, etc. with matching paint.

END OF SECTION
PART 1  GENERAL

1.1  DESCRIPTIONS

A. General: Provide wiring devices in accordance with the Contract Documents.

1.2  QUALITY ASSURANCE

A. Switches and receptacles shall be of the same manufacturer.

B. Reference shall be made to the drawings for additional wiring devices not noted in this section of the specifications.

C. Manufacturer shall have a minimum of ten (10) years experience in the manufacture of wiring devices similar to those specified on this project.

D. Manufacturer shall have ISO-9002 certification.

1.3  STANDARDS


1.4  SUBMITTALS

A. Product Data: For each type of products.

B. Shop Drawings: List and description of materials and the method for receptacle identification.

1.5  COLORS

A. Device and coverplate (thermostatic) colors connected to the normal power system shall be as selected by the Architect unless otherwise indicated on the architectural drawings:

PART 2  PRODUCTS

2.1  ACCEPTABLE MANUFACTURERS

A. Catalog numbers shall not be used to determine colors of devices and coverplates. Catalog numbers are used to establish minimum acceptable standard.
B. Switches and Receptacles: Hubbell or equivalent, by Cooper Wiring Devices, Leviton, and Pass & Seymour.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
   1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
   2. Devices shall comply with the requirements in this Section.
   3. Receive Owner approval.

D. Devices for Owner-Furnished Equipment:
   1. Receptacles: Match plug configurations.
   2. Cord and Plug Sets: Match equipment requirements.

E. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.3 SWITCHES

A. General
   1. Switches shall be of the type indicated on the Drawings.
   2. Switches shall be commercial specification grade, quiet type, 20A, 120/277V, 1 HP rated at 120V, 2HP rated at 277V, back and side wired, silent handle operation.
   3. Switch with pilot light shall be specified for applications where the load to be controlled is not in sight. Pilot light shall be long life, LED type and shall be on when the load is off.

B. Lighting Switches
   1. Toggle Handle Type
      b. 3-way: Hubbell: HBL1223.
      c. 4-way: Hubbell: HBL1224.

2.4 RECEPTACLES

A. General
   1. Receptacles shall be of the type indicated on the Drawings.
2. Receptacles shall be heavy duty 20A specification grade, 125V, grounding type, back and side wired.

B. Receptacles

2.5 WALL PLATES

A. Single and combination types to match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: 0.035-inch-thick, satin-finished stainless steel 302/304, 0.03-inch thick.
   3. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations".

PART 3 EXECUTION

3.1 INSTALLATION

A. General
   1. The exact location of wiring devices shall be determined by location of equipment and as detailed on the Architectural Drawings. Prior to installation the Owner has the right to have the devices relocated 25'-0" at no cost.
   2. Devices mounted above counters shall be 2 inches above the top of the backsplash to the bottom of the coverplate.

B. Switches
   1. Mount switches vertically with the ON position on top.
   2. Mount switches on the strike side of doors, unless otherwise detailed on the drawings.

C. Coordination with Other Trades:
   1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
   3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
   4. Install wiring devices after all wall preparation, including painting, is complete.

D. Conductors:
   1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
   2. Strip insulation evenly around the conductor using tools designed for the
purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

4. Existing Conductors:
   a. Cut back and pigtail, or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

E. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

F. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

G. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

H. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

I. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 IDENTIFICATION
A. Comply with Section 26 05 53 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with **black**-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Perform the following tests and inspections:
   1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
   2. Test Instruments: Use instruments that comply with UL 1436.
   3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

D. Tests for Convenience Receptacles:
   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. Using the test plug, verify that the device and its outlet box are securely mounted.
   5. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

E. Wiring device will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION
PART 1 GENERAL

1.1 DESCRIPTION

A. General: Provide fuses in accordance with the Contract Documents.

1.2 STANDARDS

A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
   1. UL Standard #198

1.3 SUBMITTALS

A. Provide a complete set of shop drawings to include let-thru curves for each type of fuse, a schedule of spare fuse cabinets with a listing of fuses provided within each spare fuse cabinet, and dimensioned drawings of each spare fuse cabinet by type and size.

PART 2 PRODUCTS

2.1 MATERIALS

A. Mains, Feeders and Branch Circuits
   1. General
      a. All fuses shall be labeled as UL Class L or UL Class R, current limiting and rated for up to 200,000 amperes. Time delay Class R fuses shall be so labeled.
   2. Main Service and all Feeder Circuits
      a. Fuses over 600 amperes shall be UL Class L. Fuses up to 600 amperes shall be UL Class RK1. If fuses directly feed motors or transformers, they shall be UL RK1, labeled Time-delay.
   3. Branch Circuits
      a. Feeding circuit breaker panels shall be UL Class RK1.
      b. Feeding motor circuits shall be UL Class RK1 labeled as Time-delay.
   4. All fuses shall be so selected as to provide a selectivity coordinated system.
   5. All fuses shall be of the same manufacturer.
   6. All fuses to be of the Class R type.

B. Spares: Upon completion of the building, the contractor shall provide the Owner with spare fuses as indicated below:
   1. 10 percent (minimum of 3) of each type and rating of installed fuses shall be supplied as spares.
   2. Spare fuse cabinets shall be provided to store the above spares.
3. Spare fuse cabinets shall be provided as a minimum in the following locations:
   a. Each main switchgear room.
   b. Each major mechanical equipment room.

C. Manufacturers
   1. Littelfuse, Bussmann, Gould-Shawmut.

PART 3 EXECUTION

3.1 GENERAL

   A. Fuses shall not be installed until equipment is ready to be energized.

   B. All fuses shall be provided by the Electrical Contractor.

END OF SECTION
SECTION 26 28 16 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.1 DESCRIPTION

A. Provide enclosed fusible disconnect switches in accordance with the Contract Documents.

1.2 STANDARDS

A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
   1. UL Standards #98
   2. NEMA KS-1

1.3 SUBMITTALS

A. Submit manufacturers’ data for all disconnect switches and circuit breakers.

PART 2 PRODUCTS

2.1 ENCLOSED SWITCHES

A. Enclosed switches shall be fused heavy-duty, single-throw knife switch with quick-make, quick-break mechanism, capable of full load operations. Meet NEMA and U.S. Government specifications for Class A switches. Install fused switches unless otherwise noted.

B. Provide with contact arc-quenching devices, such as magnetic blowouts or snuffing plates. Provide self-aligning switchblades with silver alloy contact areas and designed so that arcing upon making and breaking does not occur on the final contact surfaces. Provide with high-pressure, spring-loaded contact. Mount switch parts on high-grade insulating base. All safety switches shall be fused unless otherwise noted.

C. Enclosure: NEMA 1 with hinged door, and defeatable interlock when switch is in "On" position and can be positively padlocked in "on" and "off" positions. Utilize NEMA 3R (rain-tight) enclosure for exterior installations. NEMA 3R enclosures must be galvanized.
D. Size fusing and number of poles as shown or as required. Where fused, the devices must be provided with UL listed rejection feature to reject all but Class R fuses. Provide horsepower rated switch to match motor load if no size is shown. Use 3 pole plus solid neutral switches on four wire circuits and 3 pole switches on all other circuits unless otherwise noted.

E. Lugs must be UL listed for aluminum and/or copper conductors and be front removable.

F. Manufacturer to be the same as that for transformers, switchgear, etc.


2.2 TOGGLE TYPE MANUAL CONTROL SWITCHES

A. Provide switches that operate at their full rating with fluorescent, tungsten, and resistance loads – and at 80% of their rated capacity with motor loads.

B. Switches to be heavy duty and have:
   1. Arc-resisting bodies.
   2. Slow make-and-break mechanisms.
   3. Silver alloy contact buttons.
   4. Side or back wiring with up to No. 10 AWG solid conductors.

C. Acceptable manufacturers: Square D Class 2510, 11, or 12; General Electric Type RB and Siemens Class MMS with enclosure.

2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, MENA 250, and UL 50, to comply with environmental conditions at installed location.
   1. Indoor, Dry and Clean Locations: NEMA 250 Type A.
   2. Outdoor Locations: NEMA 250, Type 3R.
   4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
   5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Non-corrosive Liquids: NEMA 250, Type 12.
   6. Alarm Switch: One [NO] [NC] contact that operates only when circuit breaker has tripped.

PART 3 EXECUTION

3.1 APPLICATIONS

A. Each piece of equipment utilizing multi-phase power shall be supplied with a safety-type disconnect switch.
B. Each piece of equipment utilizing single-phase power and protected at over 30 amperes shall be supplied with a safety-type disconnect switch.

C. Motor disconnects other than mentioned above may utilize a toggle type manual control switch properly sized and rated for the equipment it disconnects.

D. Factory installed fused disconnect switches may be used to satisfy the above requirements with the Architect’s prior approval.

3.2 MOUNTING

A. Switches or circuit breakers less than 100 pounds may be mounted on the wall. Equipment over 100 pounds shall be mounted on a rack that extends from floor to ceiling. Do not mount switches or circuit breakers to equipment housing.

END OF SECTION
PART 1 GENERAL

1.1 DESCRIPTION

A. Section includes, but is not necessarily limited to, the furnishing and installation of solid state lighting (SSL) Luminaires (herein referred to as Luminaires) applied to the illumination of interior and exterior spaces. Luminaires shall be listed in accordance with national recognized testing laboratories (NETLs) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA).

1.2 RELATED DOCUMENTS

A. Specification Section 26 09 23 – "Lighting Control System".

B. Specification Section 26 51 00 – "Interior Lighting".

1.3 DEFINITIONS AND STANDARDS

A. The terms and standards used or referenced herein are defined as follows:

- **ANSI-C82.11** American National Standard for Lamp Ballasts – High Frequency Fluorescent Lamp Ballasts.
- **ANSI-C82.SSL1** SSL Drivers (in ANSI development)
- **CALiPER** Commercially Available LED Product Evaluation and Reporting 'A' US DOE program for the testing and monitoring of commercially available LED Luminaires and lights.
- **CCT** Correlated Color Temperature: Visible light characteristic of comparing a light source to a theoretical, heated black body radiator; measured in Kelvin.
- **Cd** Candela: Unit of measurement of light intensity.
- **Chromaticity** The property of color of light.
- **fc** foot-candle. Unit of illuminance.
IEEE C62.41.2 IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000V and less) AC Power Circuits.


IES-LM-80-08 Illuminating Engineering Society – Approved Methods: Measuring Lumen Maintenance of LED Light Sources.

IES LM-82-12 Illuminating Engineering Society – Approved Methods: Characterization of LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature.

IES-TM-21 Method for determining an LED luminaire or integral replacement lamp's expected operating life, based on initial performance data collected per IES-LM-80.

L80 The extrapolated life in hours of the luminaire when the luminous output depreciates 20 percent from initial values.

LED Light Emitting Diode.

METS Material Engineering and Testing Services of the Translab.

NEMA National Electrical Manufacturers Association.

NVLAP National Voluntary Laboratory Accreditation Program. A program under the US DOE to accredit independent testing laboratories to qualify.

Power Factor The ratio of the real power component to the total (complex) power component.

Rated power Power consumption that the luminaire was designed and tested for at ambient temperature.

SPD Surge Protection Device. A subsystem or component(s) that can protect the unit against short duration voltage and current surges.

SSL Solid-State Lighting.

THD Total Harmonic Distortion. The amount of higher frequency power on the power line.

B. Except as herein specified or as indicted on the Drawings, the work of this section shall comply with the following:

1. ANSI-UL Standards
   a. 924 – Emergency Lighting and Power Equipment
   b. C78.377 – Chromacity of Solid State Lighting (SSL) Products
   c. C82.11 – High Frequency Fluorescent Lamp Ballasts
   d. C82.SSL1 – SSL Drivers

2. IEC
   a. EN-61000-6-3 – EMC Emission Standards

3. NFPA
   a. 70-NEC
   b. 101-Life Safety

4. Standards as listed and referenced in this Specification.
C. All LED Luminaires shall have a CRI of at least 80, an estimated life of at least 50,000 hours at 70% lumen maintenance, and shall include a minimum 5-year warranty on the entire luminaire including the driver. The luminaire and LEDs shall have been tested in accordance with LM-79 and LM-80.

1.4 FIXTURE SCHEDULE

A. No substitutions other than the equal manufacturers listed on the light fixture schedule will be accepted, unless otherwise approved in writing by the Engineer. The lighting equipment specified herein has been carefully chosen for its ability to meet luminous performance requirements of this project. Substitutions in all likelihood will be unable to meet all of the same criteria as specified equipment.

B. Once Bids and Shop Drawings are approved, all lighting is to be ordered according to construction schedule and lead times. The Contractor is then to inform the Engineer immediately, in writing, the date when equipment orders are completed and delivery scheduled.

1.5 SUBMITTALS

A. Submit shop drawings and manufacturers' data for the following items in accordance with the conditions of the contract and as specified below.

1. Shop drawings shall be submitted with product datasheets that include the following information:
   a. General device descriptions
   b. Dimensions
   c. Wiring details
   d. Nomenclature
   e. Operating temperature range
   f. System efficacy
   g. Rated life
   h. Rated output
   i. Input wattage
   j. Inrush current
   k. THD
   l. Power factor
   m. Warranty
   n. CCT
   o. The rated life
   p. Lumen output

   This information shall be provided for the actual lumen package and driver combination specified. Provide information regarding the effects of temperature on the rated life and lumen output. If applicable, the submittal shall also include the US Department of Energy Lighting Facts label.
2. Major luminaires and special luminaires shall show full size cross sections. Indicate finished dimensions, metal thicknesses, and materials.
3. Show mounting details, including hung ceiling construction.
4. Shop drawings shall include a complete listing of all luminaires on a single sheet. This listing shall contain the luminaire type, manufacturer's catalog number, applied voltage, and wattage.
5. Submit manufacturer's fixtures and accessories Shop Drawings and data in booklet form, including rough-in dimensions, instructions for installation and maintenance.

1.6 WARRANTY

A. The manufacturer shall provide a warranty against loss of performance and defects in materials, finishes, and workmanship for the Luminaires and all components for a minimum period of 5 years after acceptance of the Luminaires. Replacement Luminaires shall be provided promptly after receipt of Luminaires that have failed at no cost to the customer. All warranty documentation shall be provided to customer prior to random sample testing.

B. Failure of the LED light source shall be defined as failure or negligible output of 10% or more individual LEDs within the LED array, bar, etc.

1.7 PROTECTION

A. Protect lighting fixtures and work against dirt, water or mechanical damage before, during, and after installation. Damage to fixtures prior to final acceptance shall be repaired or replaced at no cost to the Owner.

PART 2  PRODUCTS

2.1 MATERIALS AND FIXTURES

A. General
1. Provide all lighting fixtures in accordance with Lighting Fixture Schedule and as indicated and required on Drawings.
2. Fixture catalog numbers only indicate type and style. Provide each fixture complete with proper fixture trim, levelers, mounting brackets, flanges, plaster rings, glassware and accessories for complete installation as required for type of ceiling and room finish schedules.
3. All plastic diffusers used in lighting fixtures shall be manufactured of 100 percent virgin acrylic plastic, polycarbonate, or as otherwise noted.
4. Provide approved fireproof enclosures UL rated (UL 0529) where recessed in fire rated ceilings.
5. Provide gaskets as required to prevent light spill between frames and ceilings.
6. Provide "wet" labels on all fixtures installed outdoors or in moist areas.
7. Provide continuity of ground on all fixtures used as raceways and mounted end to end.
8. All metal parts to be chemically treated with a rust resistant phosphatized solution, internal components and reflecting surfaces to have a factor of minimum 90%.
9. Provide luminaires, completely factory-assembled and wired and equipped with necessary light sources, drivers, wiring, shielding, reflectors, channels, lenses, etc., and deliver to job ready for installation.
10. Luminaire Reflector Care: Luminaires with Alzak reflectors shall be installed with Mylar cover over reflectors. Cover shall be UL listed for temporary lighting. Upon completion of work, remove Mylar cover with white glove and blow clean reflectors.
11. Finish: Porcelain or baked enamel finish matte white on interiors with minimum test reflectance of 90% matte white finish or as specified in visible exterior. Thoroughly clean base metal and bonderize after fabrication.
12. Where utilized as raceway, luminaires shall be suitable for use as raceways. Provide feed through splice boxes where necessary. Wiring shall be rated for 90 degrees Centigrade.

B. Luminaires
1. Each luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply). If required, components such as the LED array and driver shall be modular and replaceable without removing the luminaire.
2. Each luminaire shall be rated for a minimum operational life as specified on lighting fixture schedule or per basis of design luminaire, as defined by IES LM-80 and TM-21.
3. Each luminaire shall be designed to operate at an average operating temperature of 25°C.
   a. The typical operating temperature range shall be -10°C to +25°C, unless otherwise specified on lighting fixture schedule and Drawings.
   b. Some parameters and tests (such as IESNA standard LM-80-08) shall be conducted at different ambient temperatures.
4. Each luminaire shall meet all parameters of this specification throughout the minimum operational life when operated within the rated temperature range.
5. The individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.
6. Each luminaire shall be listed with a nationally recognized testing laboratory (including but not limited to UL, CSA, ETL) under UL 1598 and UL 8750, or an equivalent standard from a recognized testing laboratory.

C. LEDs
1. The light source of the luminaires shall consist of LED arrays or bars. If required, the LED arrays or bars shall be removeable.
2. The LEDs shall be either white or RGB, according to the light fixture schedule and Drawings. For luminaires specified with white light, it is not acceptable to provide RGB LEDs mixed to produce white light.
3. Refer to the light fixture schedule and Drawings for the specified correlated color temperature (CCT) of each luminaire.
4. Individual LEDs shall be binned by manufacturer to comply with ANSI C78.377.
5. The LEDs shall be manufactured by Cree, Philips, Toshiba, Osram, Samsung, or Nichia, unless otherwise noted.

D. Drivers
1. The driver or power supply for the luminaire shall be modular and replaceable.
2. The rated life of the driver shall match the rated life of the LEDs and luminaire.
3. In general, the drive current rating of the driver shall be minimized, while still maintaining the required lumen output, to improve luminaire efficiency and life.
4. The driver shall meet the emission standards of IEC EN-61000-6-3 at a minimum. For healthcare or other applications with EMI sensitive equipment, provide drivers that meet more stringent standards as required.

E. Exit Lighting
1. Exit lighting system shall be as indicated on Drawings.
2. Equipment shall be complete with LED light sources.
3. Where indicated as such, provide battery pack and charger with self-diagnostics for illumination under power failure conditions.
4. Equipment shall meet BOCA, OSHA, NFPA and NEC illumination standards.

F. Emergency Lighting
1. Provide GTD or GTD20A transfer devices suitable for use with solid-state lighting (Bodine or approved equal manufacturer) as indicated on drawings, light fixture schedule, and lighting control schedule.

2.2 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: ½ inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, ½ inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

PART 3 TECHNICAL REQUIREMENTS

3.1 ELECTRICAL
A. Power Consumption: Maximum power consumption allowed for the luminaire shall be per basis of design light fixture listed on lighting fixture schedule.

B. Operation Voltage
   1. The luminaire shall operate from a 60 HZ ±3 HZ AC line over a voltage ranging from 110 VAC to 277 VAC as specified on the drawings. The fluctuations of line voltage shall have no visible effect on the luminous output.
   2. The standard operating voltages are 120 VAC as shown on drawings.

C. Current: The inrush current for the luminaire shall be published on the luminaire data sheet and shall be less than that of the basis of design fixture listed on the light fixture schedule.

D. Power Factor: The luminaire shall have a power factor of 0.90% or greater at all standard operating voltages.

E. THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 20 percent at any standard input voltage. The luminaire shall comply with ANSI C82.11, or equivalent ANSI LED Standard C82.SSL1.

F. Surge Suppression: The luminaire shall include surge protection to withstand high repetition noise and other interference.
   1. The surge protection which may reside within the driver shall protect the luminaire from damage and failure for transient voltages and currents as defined in ANSI/IEEE C64.41 for Location Category A Low. Where failure does not mean a momentary loss of light during the transient event.
   2. Surge protection performance shall be tested per the procedures in ANSI/IEEE C62.45 based on ANSI/IEEE C62.41 definitions for standard and optional waveforms for Location Category A-Low.

G. Operational Performance: The LED circuitry shall prevent perceptible flicker to the unaided eye over the voltage range specified above.

H. RF Interference: The luminaire and associated on-board circuitry must meet Class A emission limits referred in IEC EN-61000-6-3 and Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise.

I. Dimming: Where dimming is specified on the drawings, the luminaire shall be capable of continuous dimming without perceptible flicker over a range of 100% to 5% of rated lumen output. Dimming shall be controlled by a 0-10V signal, unless otherwise noted or specified.
   1. Dimming switches and other control system components shall be compatible with the LED driver type – constant current reduction (CCR) or pulse-width modulation (PWM). The device(s) shall be rated to accommodate full load, as well as inrush current and repetitive peak currents.
2. The luminaire and dimming controls shall produce a smooth change in lumen output, without any visible flicker.
3. The luminaire shall be capable of dimming without any visible change in CCT and color rendition.

J. Multi-Level Control: Where specified on drawings, the luminaire shall be provided with multiple power supplies, multi-level power supply, or other similar means to facilitate multi-level control of luminaire.

K. Temperature Range: The luminaire shall have the capability of operating and maintaining rated lumen output and rated life within the temperature range specified on the lighting fixture schedule and Drawings, or within that of the basis of design luminaire if no temperature range is specifically listed.

L. Lumen Output and Performance
1. The luminaire shall maintain the lumen output specified on the lighting fixture schedule and Drawings, or that of the basis of design luminaire if no minimum lumen output is specifically listed.
2. The lumen output shall be maintained regardless of ambient temperature fluctuations, within the rated temperature range. The luminaire data sheets shall specify any effect or variation on lumen output from temperature.
3. The luminaire shall be capable of continuously monitoring system performance to allow for constant lumen management/compensation, if specified in lighting fixture schedule, Drawings, or basis of design luminaire.
4. The luminaire shall provide a total system efficacy that meets or exceeds that of the basis of design luminaire listed on the light fixture schedule and Drawings.

M. Rated Life: The luminaire shall have a rated life that meets or exceeds that listed on the lighting fixture schedule and Drawings, or that of the basis of design luminaire if no rated life is specifically listed.

3.2 PHOTOMETRIC REQUIREMENTS

A. Light Output
1. The minimum initial lumen output of the luminaire exiting the luminaire in the 0-90 degree zone - as measured by IESNA Standard LM-79-08 shall be as specified in the lighting fixture schedule and Drawings, or that of the basis of design luminaire if no lumen output is specifically listed.
2. The lumen output shall not decrease by more than 30% over the minimum operational life (or L70 shall be at least the minimum number of hours specified).
3. The measurements shall be calibrated to standard photopic calibrations.

B. Light Color/Quality
1. Corrected Color temperature (CCT) range shall be correlated to chromaticity as defined by the absolute (X,Y) coordinates on the 2-D CIE chromaticity chart.
2. The color rendition index (CRI) shall be 80 or greater for interior applications, and 70 or greater for exterior applications.

3.3 THERMAL MANAGEMENT

A. The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to assure proper operation of the luminaire over the expected useful life.
   1. The LED manufacturer's maximum junction temperature for the expected life shall not be exceeded at the average operating ambient.
   2. The LED manufacturer's maximum junction temperature for the catastrophic failure shall not be exceeded at the maximum operating ambient.
   3. The luminaire shall have an UL IC rating, if applicable.

B. The Driver manufacturer's maximum case temperature shall not be exceeded at the maximum operating ambient. Thermal management shall be passive by design.
   1. The use of fans or other mechanical devices shall not be allowed.

3.4 PHYSICAL AND MECHANICAL REQUIREMENTS

A. The luminaire shall be a single, self-contained device, not requiring on-site assembly for installation. The power supply for the luminaire shall be integral to the unit, unless otherwise specified.

B. The assembly and manufacturing process for the SSL luminaire shall be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration.

C. The optical assembly of the luminaire shall be constructed so that individual LED images shall not be visible to the occupant.

D. The electronics/power supply enclosure shall be internal to the SSL luminaire and be accessible per UL requirements.

E. The circuit board and power supply shall be contained inside the luminaire.

F. Electrical connections between normal power, driver and LED boards must be modular utilizing a snap fit connector. All electrical components must be easily accessible after installation from the room side and all electrical components must to be able to be replaced without removing the fixture from the ceiling.

G. For LED retrofit lamps, the weight of the unit shall be in compliance with weight ratings of the lamp sockets/bases.

3.5 MATERIALS
A. Housings shall be fabricated from material indicated on lighting fixture schedule.

B. If applicable, refractor or lens shall be made from UV inhibited high impact plastic (such as acrylic or polycarbonate) or heat and impact resistant glass.

C. If applicable, polymeric materials of enclosures containing either the power supply or electronic components of the luminaire shall be made of UL94VO flame retardant materials. The lenses of the luminaire are excluded from this requirement.

3.6 LUMINAIRE IDENTIFICATION

A. Each luminaire shall have the manufacturer's name, trademark, model number, serial number, date of manufacture (month-year), and lot number as identification permanently marked inside the each unit and the outside of each packaging box.

B. The following operating characteristics shall be permanently marked inside each unit: rated voltage and rated power in Watts and Volt-Ampere.

3.7 QUALITY ASSURANCE

A. The luminaires shall be manufactured in accordance with a manufacturer quality assurance (QA) program. The QA program shall include two types of quality assurance: (1) design quality assurance and (2) production quality assurance. The production quality assurance shall include statistically controlled routine tests to ensure minimum performance levels of the modules built to meet this specification, and a documented process of how problems are to be resolved.

B. QA process and test results documentation shall be kept on file for a minimum period of seven years.

C. LED luminaire designs not satisfying design qualification testing and the production quality assurance testing performance requirements described below shall not be labeled, advertised, or sold as conforming to this specification.

D. Design Qualification Testing
1. Design Qualification Testing shall be performed by a National Voluntary Laboratory Accreditation Program (NVLAP) testing facility. Such testing may be performed by the manufacturer or an independent testing lab hired by the manufacturer on new luminaire designs, and when a major design change has been implemented on an existing design. A major design change is defined as a design change (electrical or physical) which changes any of the performance characteristics of the luminaire, results in a different circuit configuration for the power supply, or changes the layout of the individual LED's in the module.
2. A quantity of two units for each design shall be submitted for Design Qualification Testing.
3. Product submittals shall be accompanied by product specification sheets or other documentation that includes the designed parameters as detailed in this specification. These parameters include (but not limited to):

4. Maximum power in Watts
5. Maximum Designed Junction Temperature
6. L70 in hours, when extrapolated for the average operating temperature
7. Product submittals shall be accompanied by performance data that is derived in accordance with appropriate IESNA testing standards and tested in a laboratory that is NVLAP accredited for Energy Efficient Lighting Products.
8. Product submittals shall be accompanied by a test report showing surge protection performance as tested per the definitions and procedures in ANSI/IEEE C62.41 1991
9. Thermal testing data and reporting shall be provided based on the sensor input as defined below:
   a. Temperature sensors shall be mounted on the LED solder pads as close to the LED as possible.
10. Burn-In: Before any customer design qualification testing is performed, the sample Luminaires shall be energized for a minimum of 24 hours, at 100 percent on-time duty cycle, at a temperature of +70°F (+21°C).
11. Any failure of the luminaire, which renders the unit non-compliant with the specification after burn-in, shall be cause for rejection.
12. The luminaire shall be tested as described herein.
   a. Luminaire performance shall be judged against the specified minimum illuminance in the specified pattern for a particular application.
   b. The luminaire lighting performance shall be adjusted (depreciated) for the minimum life expectancy.
      1) The performance shall be adjusted (depreciated) by using the LED manufacturer's data or the data from the IESNA Standard LM-80-08 test report, which ever one results in a higher level of lumen depreciation.
   c. The luminaire may be determined to be compliant photometrically, if:
      1) The initial minimum illuminance level is achieved in 100% of the area of the specified lighting pattern, and
      2) The depreciated minimum illuminance is maintained in at least 95% of the area of the specified lighting pattern, and
      3) The minimum length of the depreciated iso-footcandle curve is equal or greater than the length of the specified iso-footcandle curve.

3.8 QUALITY ASSURANCE TESTING (RANDOM SAMPLE TESTING)

A. Random sample testing may be performed on all shipments.

B. Testing shall be completed within 30 days.

C. All parameters of the specification may be tested on the shipment sample.
PART 4 EXECUTION

4.1 INSPECTION AND PREPARATION

A. General
1. Install outlets, surface mounted, recessed or semi-recessed fixtures to maintain the alignment, spacings, layout and general arrangements indicated in the Drawings. Obtain approval of Engineer for all changes in layout required to avoid interferences with other trades.
2. Install one light fixture of each type and mounting for approval of Owner and Engineer prior to mounting all light fixtures.

B. Coordination
1. Work incorporating with ceiling trades in locating and framing recessed fixtures in acoustical tile pattern or grid system to conform to layout.
2. Inform affected trades of the location and framing details necessary for the installation of flush fixtures and deliver all framing rings of these fixtures that become a part of the ceiling construction.
3. Before equipment is ordered, electrical contractor to review luminaire and ceiling mechanical compatibility in each area and verify luminaire on the drawings. Contractor shall be responsible for all fixture quantities, lengths and clearances required and shall inform the Owner of the job conditions at variance with the fixture(s) specified or detailed which affect installation or location. (All stages of installation.)
4. Mechanical and electrical contractors are to review and coordinate lighting locations in relationship to mechanical systems to minimize conflicts prior to installation.
5. This contractor is responsible for coordinating the characteristics and the U.L. labeling of the luminaires and their components with the ambient conditions, which will exist when the luminaires are installed. No extra compensation will be permitted for failure to coordinate the luminaires with their ambient conditions.

C. Mounting and Supports
1. Install luminaires in mechanical and unfinished areas after ductwork and piping installation.
2. Where luminaires are surface mounted, they shall be labeled for such and a minimum of one-half (1/2) inch air space and shall be maintained between top of luminaire and mounting surface by an approved means.
3. Pendant mounted units shall comply with the following:
   a. Where luminaires are mounted in a continuous row, luminaires, eight feet in length shall have stems placed within 2'-0" of end of fixture. Stems shall be spaced symmetrically. A fixture, four feet or three feet in length, placed in a row, shall have a stem connected to center luminaire.
   b. Individual luminaires, four feet in length, shall have two stems placed approximately 3 inches from each end.
c. Individual luminaire, three feet in length, shall have dual stems and a single canopy.
d. Each stem shall have a brass or steel swivel or other self-aligning device of type approved by the Engineer.

4. Where luminaires are mounted on surface-mounted outlet boxes in surface mounted conduit runs, this Contractor shall furnish and install a luminaire canopy sufficiently deep to permit exposed conduits to pass through. Canopy shall have proper openings cut by luminaire manufacturer through which conduits may pass. Submit sample of canopy for approval before installation.

5. Prior to final payment, this contractor shall clean all luminaires and replace any burned out LED modules. He shall also touch up all scratch marks, etc. in an approved manner.

6. Provide a minimum of two support points for all surface, pendant or recessed mounted luminaires. The supports shall be tied to the building structural system. The support points shall be totally independent of the ceiling system.

7. Recessed luminaires to be installed in metal panel or acoustic modular ceilings shall be modified as required to fit into openings in ceiling construction. Shop Drawings showing details shall be submitted for approval.

8. All luminaires in hung ceilings are to be installed with earthquake clips.

D. Emergency Systems Raceway and Hook-up

1. Circuit wiring for the emergency systems shall be installed in separate raceway and kept entirely independent of all other wiring and equipment.

4.2 ADJUSTING AND CLEANING

A. At project completion, before final approval:

1. Aim adjustable fixtures as directed by Engineer and observe and adjust at night as required.

2. Clean interior of all fixtures, all lenses and LED modules.
PART 1  GENERAL

1.1  SUMMARY

A.  This specification includes:
   1.  The furnishing, delivery, provision, and installation of theatrical lighting fixtures, control systems, and related equipment for the following rooms:
      a.  Auditorium
   2.  The fabrication, furnishing, delivery, provision, and installation of theatrical rigging systems and related equipment for the following rooms:
      a.  Auditorium

1.2  APPLICABLE STANDARDS AND DEFINITIONS

A.  Standards
   1.  All theatrical lighting equipment and installation specified in this section shall comply with the most recent version of the following standards:
      d.  ANSI E1.31 – 2009, Entertainment Technology – Lightweight streaming protocol for transport of DMX512 using ACN.
      f.  ANSI E1.27-2 – 2009, Entertainment Technology - Recommended Practice for Permanently Installed Control Cables for Use with ANSI E1.11 (DMX512-A) and USITT DMX512/1990 Products.
      2.  All theatrical rigging systems and installation specified in this section shall comply with the most recent version of the following standards:
      b.  ANSI E1.6-1 – 2012: Entertainment Technology – Powered Hoist Systems
      d.  AWS D1.1 – Structural Welding Code-Steel.
      e.  ASTM A-36 -Specification for structural steel
      f.  ASTM A-47 - Specification for malleable iron casting
g. ASTM A-120 - Specification for black and steel pipe for ordinary use
h. ASTM B18.2.1&2 - Specification for square and hex bolts and nuts

1.3 DEFINITIONS

A. “TEC” Theatrical Equipment Contractor
   1. Shall mean the contractor responsible for furnishing and mechanical installation of the equipment specified in this section

B. “EC” Electrical Contractor
   1. Shall mean the contractor responsible for the electrical installation of the equipment specified in this section

C. “ETCP:CEE”
   1. Shall be the designated abbreviation for an individual holding a valid certification as an Entertainment Technician Certification Program: Certified Entertainment Electrician.

D. “ETCP:CR-T”
   1. Shall be the designated abbreviation for an individual holding a valid certification as an Entertainment Technician Certification Program: Certified Rigger-Theatre.

E. “NRTL”
   1. Shall be defined as any OSHA recognized National Recognized Testing Laboratory.

1.4 CONTRACTOR QUALIFICATIONS

A. Theatrical Equipment Contractor (TEC)
   1. The furnishing, fabrication, integration, and installation of the equipment specified in this section shall be the responsibility of one TEC.
   2. The TEC shall be an ETCP Recognized Employer with a valid and current listing at etcp.plasa.org.
   3. The TEC shall:
      a. have been in business for a minimum of 10 years.
      b. for the duration of the project, employ and designate a single Project Manager.
      c. employ as full time staff a designated individual who shall possess and maintain a valid certification as an ETCP:CEE
      d. employ and designate a single Lighting Field Superintendent responsible for coordinating the installation of all theatrical lighting systems as specified in this section for the duration of the installation process.
      e. employ and designate a single Rigging Field Superintendent responsible for coordinating the installation of all theatrical rigging systems as specified in this section for the duration of the installation process.
1) The Rigging Field Superintendent shall possess and maintain a valid certification as an ETCP:CR-T
2) The Rigging Field Superintendent shall NOT be the same individual as the TEC’s designated Project Manager.
3) The Rigging Field Superintendent shall be a full time employee of the TEC and shall be empowered to speak for the TEC, make field modifications to the plans and fully coordinate the project; commit to schedule, attend site meetings, coordinate with other trades and perform other site duties as may be required.

4. Approved Theatrical Equipment Contractors (TEC)
   a. The TEC for this specification section shall be one of the following:
      1) Parlights, Inc. | 1662 Bowmans Farm Road, #111 | Frederick, MD 21701 | Phone: 301.698.9242
      2) 4 Wall Entertainment, Inc.| 9525 Berger Road, Suite G | Columbia, MD| Phone: 410.242.3322
      3) Barbizon Capitol | 6437 General Green Way | Alexandria, VA 22312 | Phone: 703.750.3900
      4) WNP Services, Inc. | 9345 Mike Garcia Dr.| Manassas, VA 20109| Phone: 703.659.4891

5. Requirements for Approval:
   a. Other Contractors seeking acceptance must submit the following information at least (2) weeks prior to the scheduled bid opening date. Only TEC’s that have been pre-approved for the Theatrical Lighting Systems or have been approved by addenda for the Theatrical Lighting System will be accepted. Failure to submit any of the required information will automatically disqualify the TEC from consideration for approval.
      1) A listing of five (5) equivalent installations, including:
      2) A brief written description of the Contractor’s operation including facilities, financial capabilities, and experience of key personnel.
      3) Written certification that the contractor maintains as a full time employee on-staff within (120) miles of the Project Site properly trained and factory-certified service technicians capable of diagnosing, certifying, and maintaining the Theatrical Equipment and Systems detailed in this specification.
         a) Technician shall be qualified for equipment and systems including, but not limited to, relay/dimmer panels, control systems, and LED Luminaires
         b) Contractor shall list service technicians by name in the request for approval and provide verification of manufacturer certification per system and equipment type.
         c) Contractor shall provide the phone number for a TEC maintained 24-hour service hotline.
         d) Technician shall be qualified for theatrical rigging equipment and systems including, but not limited to, line-shaft winches, motorized roll drops, and programmable logic controls for motorized rigging.
e) Contractor shall list qualified individuals by name in the request for approval and provide verification of ETCP:CR-T and specific qualifications for the specified equipment per system and equipment type.

4) Licensing information, including:
   a) Verification from the office of Secretary of State of the State in which the work is to be performed verifying that the Contractor is a registered Corporation with that State in good standing.
   b) A copy of the Contractor’s valid Contractors License for the State in which the work is to be performed. The license should be applicable to the work of this Section and should be valid for projects not less than $120,000 in value.

1.5 RELATED WORK - NOT INCLUDED IN THIS SECTION

A. Structural steel and miscellaneous metals not specifically called out on the drawings or as part of this section.

B. Galleries, ladders and catwalks.

C. Electrical connections, conduit, boxes and wiring of any type.

D. Architectural Lighting Fixtures and associated wiring

1.6 SUBMITTALS

A. Drawings: Submit (3) sets of component and installation drawings and scheduled showing all information necessary to fully explain the design, features, appearance, function, fabrication, installation, and use of theatrical lighting and rigging system components in all phases of operation.

B. Submittal Package shall include, but not be limited to, the following:
   1. Theatrical Lighting Equipment and Systems
      a. Detailed Drawings and Specifications for all theatrical lighting system components
      b. Detailed system one-line diagrams to include:
         1) All system components
         2) Clear delineation of all control wiring types and requirements
      c. Fully dimensioned drawing indicating the location and elevation of control stations, control receptacles, equipment racks, and panels as well as coordination drawings showing the interrelationship of all stage rigging, stage curtains, and stage lighting systems.
         1) Drawings shall include, but not be limited to, plan, transverse section, and elevation
         2) Drawings shall note overhead obstructions such as MEP Systems and shall be coordinated with the submittals of MEP trades
d. Schedules and details to fully document the configuration and function of the theatrical lighting control system to include:
   1) Schedule of IP Addresses for each and every device to be connected to the lighting control system via Ethernet
   2) Schedule of Control Station ID’s/ Addresses for each and every device to be connected to the Architectural/ Preset Control System
   3) Detailed attribute by attribute schedule sufficiently defining the behavior of each and every dimmer, relay, and fixture per preset and schedule.
   4) Schedule detailing the eDMX patch of every input device, output device, and attribute of a lighting fixture to be connected to the theatrical lighting system. eDMX patch shall clearly designate both Control Console and Architectural/ Preset Control assignments per device and priority settings if applicable.
   5) Proposed Touch Screen layouts for each Touch Panel in the Architectural/ Preset Control System, sufficiently describing the layout, function, and operation of the controls per mode.
   6) Engraving Schedules for all Entry and Preset Recall Stations

e. Catalog Cuts for lighting fixtures and fixture accessories. These must include full information on dimensions, construction, and applications to permit proper evaluation. In addition, catalog cuts must be properly identified as to their intended use. Any options or variations must be clearly noted.

f. Lighting Design drawings to include:
   1) Lighting Fixture hanging plot showing positions for all stage lighting fixtures provided.
   2) Lighting focus diagram detailing the intended focus location for all fixtures
   3) Lighting Fixture circuiting diagram that shall include:
      a) All necessary DMX/EDMX addressing information for each fixture.
      b) All necessary control system channel assignments for each fixture or circuit.

g. Photometric layouts per room for all house light fixtures detailing:
   1) Correct lenses to achieve even coverage with the submitted fixture.
   2) Estimates of coverage and intensity per room.

h. Training Syllabus per room, detailing:
   1) Outline of subjects to be covered per training session.
   2) Recommended Owner personnel per training session.

i. Manufacturers cut sheets or standard drawings that do not show physical and wiring details specific to the conditions of this project and equipment mounting locations shall not be acceptable.

j. It shall be the ultimate responsibility of the TEC to verify and submit a comprehensive shop drawing package of all theatrical lighting equipment, fabrication, and installation specified in this section.

2. Theatrical Rigging Equipment and Systems
a. Detailed Drawings and Specifications for all theatrical rigging system components
b. Detailed system one-line diagrams to include:
   1) All system components of the rigging control system.
   2) Clear delineation of all control wiring types and requirements for motorized rigging devices and controls.
   3) Clear delineation of all electrical service, power, and wiring requirements for motorized rigging devices and controls.
c. Fully dimensioned drawing indicating the location and elevation of rigging control stations, control receptacles, equipment cabinets, and panels as well as coordination drawings showing the interrelationship of all stage rigging, stage curtains, and stage lighting systems.
   1) Drawings shall include, but not be limited to, plan, transverse section, and elevation
   2) Drawings shall note overhead obstructions such as MEP Systems and shall be coordinated with the submittals of MEP trades
   3) Drawings shall include building structure supporting rigging equipment and shall be coordinated to include beams, trusses, and structures supporting rigging equipment and the attachment of rigging equipment to these structures.
d. Schedules and details to fully document location and composition of all battens, winches, machines, tracks, and curtains.
e. Fabric Samples and color selection charts or swatches for stage curtains.
f. All shop drawings listed under this paragraph shall be submitted with the seal of a Professional Structural Engineer licensed in the State of Maryland. Drawings not bearing this seal shall be rejected without review.
   1) Mounting and attachment details for all components of the motorized rigging system as specified herein.
   2) Mounting and attachment details for all components of the tension wire grid system as specified herein.
   3) Mounting and attachment details for all dead hung rigging equipment attached directly to the building structure including battens, tracks, and roll drops.
g. All shop drawings listed under this paragraph shall be submitted for approval and shall not require, but not preclude if requested, the seal of a Professional Structural Engineer licensed in the State of Maryland.
   1) Detailed drawings for the construction and mounting of all Stage Curtains and Curtain Track Systems in accordance with the performance requirements specified in this section.
   2) Detailed layouts and descriptions for all Rigging Control System Touchscreen pages and functions.
h. Training Syllabus per room, detailing:
   1) Outline of subjects to be covered per training session.
   2) Recommended Owner personnel per training session.
i. Manufacturer’s cut sheets or standard drawings that do not show mounting and attachment details specific to the conditions of this project and equipment mounting locations shall not be acceptable.
j. Partial submittals or submittals that are not properly coordinated to show theatrical rigging equipment in a single, coordinated, and comprehensive package shall be rejected without review.

k. It shall be the ultimate responsibility of the TEC to verify and submit a comprehensive shop drawing package of all theatrical rigging equipment, fabrication, and installation specified in this section.

C. Submittal Packages that do not contain all of the completed drawings and schedules listed above shall be rejected without review.

1.7 WARRANTY

A. The TEC shall provide a three year written guarantee against defects in materials or workmanship starting from the date of acceptance of equipment by the Owner’s representative.

1. This guarantee shall include any and all required equipment inspections necessary to maintain the manufacturer’s warranty in full effect.
   a. A lapse in the manufacturer’s warranty resulting from a failure to perform timely inspections shall not relieve the TEC from its obligations under this guarantee.

2. This guarantee shall not cover damage due to normal wear and tear, acts of God, neglect, or improper use of equipment.

B. Any required maintenance or replacement shall be provided by the TEC within thirty days of notification by the Owner except for safety related items, which shall be corrected within 48 hours of notification.

C. Subsequent to the expiration of the guarantee period the TEC agrees to furnish repair and maintenance service, at the Owner’s expense, within thirty days of request for such service. The TEC shall maintain a service organization and be willing to enter into a service contract with the Owner after the warranty period has expired. Such contract shall be negotiated between the Owner and the TEC.

D. The TEC shall maintain a 24 hour service hotline. This service hotline shall be provided in addition to any manufacturer provided service hotline. Any calls placed to the service hotline during the warranty period shall be answered within 60 minutes. The TEC shall maintain replacement parts for each and every aspect of the theatrical lighting system and shall present themselves at the jobsite within 1 business day of notification by the Owners designated personnel with the appropriate replacement parts.

E. A complete inspection of the theatrical lighting and rigging system shall be performed 12 months following substantial completion. The findings shall be provided to the Owner in the form of a detailed written report.

1.8 QUALITY ASSURANCE
A. The TEC shall be responsible for integrating equipment from multiple Approved Manufacturers into a complete and working system.

B. Due to the highly specialized nature of theatrical equipment, all equipment must be manufactured by the following Approved Manufacturers:

1. Theatrical Lighting Equipment
   a. Signify/Strand Lighting: Approved equipment shall be strictly limited to Relay & Dimming Panels, Architectural/Preset Lighting Controls, Lighting Control Consoles, Circuit Distribution, DMX/Power Distribution, Company Switches, Theatrical Lighting Fixtures and accessories, UL924 DMX Bypass, LED and Automated Lighting Fixtures and UL1008 Emergency Transfer Switch.
   b. Altman Stage Lighting: Approved equipment shall be strictly limited to Theatrical Lighting Fixtures & Accessories, Work Lighting Fixtures, House Lighting Fixtures, and DMX/Power Distribution.
   c. Canto USA: Approved equipment shall be strictly limited to Followspots and Houselights Fixtures.
   e. MA Lighting: Approved equipment shall be strictly limited to: Lighting Control Console and Lighting Control Network.
   f. Pathway Connectivity: Approved equipment shall be strictly limited to Lighting Control Network, DMX Distribution, Relay Panels.
   g. SSRC: Approved equipment shall be strictly limited to Circuit Distribution, DMX/Power Distribution, Relay Panels, and UL1008 Emergency Transfer Switch.
   h. Union Connector: Approved equipment shall be strictly limited to Company Switches and UL1008 Emergency Transfer Switch.

2. Theatrical Rigging Equipment
   a. JR Clancy, Inc.: Approved equipment shall be strictly limited to Tensioned Wire Grid System, Dead Hung Rigging, Motorized Rigging Equipment, Stage Curtains and Track, Box Boom Tormentor Lighting Support Assemblies.
   b. Formance, Inc.: Approved equipment shall be strictly limited to Motorized Roll Drops, Motorized Rigging Controls, Tensioned Wire Grid System, Dead Hung Rigging, Stage Curtains and Track, Box Boom Tormentor Lighting Support Assemblies, and Theatrical Pipe Grids.
   c. Automatic Devices Company: Approved equipment shall be strictly limited to Stage Curtains and Track.
   d. H&H Specialties, Inc: Approved equipment shall be strictly limited to Stage Curtains and Track.
e. Electronic Theatre Controls: Approved equipment shall be strictly limited to Motorized Rigging Equipment, Motorized Rigging Controls

C. Rigging Systems, Minimum Standards of Safety, the following factors shall be used:
   1. Cables and Fittings: 8:1 Safety Factor.
   2. Cable D/d ratio: Sheave tread diameter is the minimum D/d ratio per the "Wire Rope User Manual" or recommended by the wire rope manufacturer.
   3. Tread Pressures: 500 lbs. for cast iron, 900 lbs. for Nylatron, 1000 lbs. for steel.
   5. Steel: 1/5 of yield strength or per AISC Specification.
   8. Motors: 1.0 NEMA Service Factor.
   9. Gearboxes: 1.25 Mechanical Strength Service Factor, 1.0 Gearing Service Factor.

1.9 SUBSTITUTIONS

A. In no case will materials of lesser design or workmanship be acceptable. Any TEC proposing to use a substitute material or item of equipment must guarantee the suitability of the recommended substitution. Approval of a manufacturer does not guarantee acceptance of equipment. Submittals for equipment and systems by Manufacturers not approved before bid day shall be rejected without review.

B. Requirements for Approval: To request approval for alternate manufacturers, an approved TEC shall submit a request for approval at least 2 weeks prior to the scheduled bid date.

   1. Approval requests shall include, but not be limited to:
      a. Evidence that the manufacturer has been in business for a minimum of ten years manufacturing theatrical lighting equipment.
      b. A listing of (10) equivalent installations, including:
         1) Name, address, and telephone number of Owner
         2) Name, address, and telephone number of Architect
         3) Scope of Work
      2. A detailed written description of the manufacturer’s operation including facilities capabilities, and experience of key personnel.
      3. A statement from an insurance company indicating that the manufacturer carries a primary product and general liability insurance of $2,000,000 each and excess liability of $10,000,000.
      4. Appropriate manufacturer’s literature, catalog, cut sheets and product data sheets sufficient to permit the Architect or Engineer to make a meaningful and informed decision to accept the substitution.
      5. A detailed statement indicating paragraph by paragraph and drawing by drawing wherein the equipment to be offered complies with or deviates from the equipment and systems described by these specifications and the project drawings.
      6. Failure to submit any of the required information will automatically disqualify the manufacturer from consideration of approval.
C. Requests for approval of alternate manufacturers must come from an approved TEC.

D. Requests for approval from entities other than approved TEC’s will be rejected without review.

E. Approval of alternate manufacturers shall be by addenda

PART 2 PRODUCTS

2.1 LOAD CONTROLLERS

A. Lighting Control Panel RP-1
   1. Overview.
   a. The Lighting Control Panel shall be fully digital, designed specifically for architectural and entertainment lighting control applications, and shall consist of 12, 24, 36 or 48 relays per panel. Panels shall have integral breakers and 3 phase main lug only inputs. The basis of design for the Lighting Control Panel shall be Contact as manufactured by Signify/Strand Lighting.
   b. The Lighting Control Panel shall be appropriately listed by a recognized NRTL for permanent installation as a recessed or pendant mounted fixture.
   c. The Lighting Control Panel shall, at a minimum, comply with the following standards:
      2) ANSI E1.31 – 2009, Entertainment Technology – Lightweight streaming protocol for transport of DMX512 using ACN.
   d. Panels shall have integral breakers and 3 phase main lug only inputs.
   2. Mechanical.
      a. The relay panel shall be a wall-mount, dead-front switchboard, substantially framed and enclosed with 16-gauge, formed steel panels. All panel components shall be properly treated, primed and finished in fine texture, scratch resistant paint.
      b. Contact Relay panels shall be available to ship as a complete assembly or in two parts consisting of a wall mount enclosure and a relay panel insert with all electrical and electronic components preassembled.
   3. Installation.
      a. A wall mount enclosure shall be available to ship separately to permit wall mounting and conduit stub in. The relay sub panel shall be factory pre-wired and dressed. The contractor shall provide and terminate all feed, load and control wiring on screw terminals fitted within the panel.
      b. Cable entry for all panels shall be on the top of the panel. Knockouts shall also be available on the sides of the panel to simplify wiring.
c. All terminations and internal wiring shall be accessible via a removable front cover panel. The Processor Module shall be accessible for programming at all times.

4. Electrical.
   a. The power efficiency of the relay panel shall be greater than 95% at full load.
   b. The relay panel shall have an internal power supply to support up to (16) 24vdc architectural control stations
   c. The system ground shall be made at a grounding lug in the panel.
   d. The panel shall have a 14,000 AIC fault current rating at 277 volts.
   e. The panel shall be a NEMA 1 enclosure and shall be CSA listed.
   f. The panel shall be suitable for surface or recess mounting.
   g. As an option the panel may be equipped for UL 924 emergency lighting applications.

5. Panel Electronics, Physical.
   a. The main panel control electronics shall be housed in one Panel Processor Module (RPM). The panel control electronics shall be completely digital without employing any digital to analog demultiplexing schemes.
   b. All panel setup and preset data shall be stored in a non-volatile manner and may be transferred to a replacement Panel Processor Module without losing data.
   c. Each Panel Processor Module shall have a display and indicator lamps with a keypad for panel setup, preset control, testing, panel status, error and diagnostics.
   d. The Panel Processor Module shall be permanently mounted inside the panel. The RPM shall provide all necessary low voltage signal connections.
   e. All DMX512 & RS485 communication ports and remote contact input connections shall be optically isolated from all processor electronics by a minimum of 2,500V RMS isolation.

6. Panel Electronics, Control And Communications.
   a. The control electronics shall provide the following control and communication inputs as standard:
      1) One optically isolated DMX512 control input.
      2) An RS485 control input for Architectural/Preset Control.
      3) ANSI E1.31 – 2009 compliant Ethernet input

7. Panel Electronics, Features.
   a. The control electronics shall provide the following setup functions that shall be user programmable on a per panel basis using an integrated display and buttons on the face of the panel:
      1) DMX512 Port A patch.
      2) ANSI E1.31 – 2009 DMX512 patch.
      3) Architectural patch Architectural/Preset control systems.
      4) Clock events.
      5) Set control input priority logic.
   b. The control electronics shall provide a facility to disable the output of any individual relay by switching the relay off.
8. Mechanical.
   a. Relays shall be snap in factory wired units in single or double pole configurations.
   b. All relays shall be designed for repeat operation with mechanically operated contacts.
   c. Relays may be operated locally with a manual over-ride.
   d. Due to physical mounting restrictions in designated areas, overall depth of each relay panel shall not exceed 4” from the face of the wall to which it is mounted.

   a. Relays shall be rated for 120 volts.
   b. All relays shall be capable of continuous operation at full rated load. They shall be rated for tungsten, LED, cold cathode and HID loads.
   c. Each assigned relay shall have a programmable switching threshold between 1 and 99%.
   d. All relays shall have a local control switch to turn the relay on for testing and diagnostic purposes.

    a. Ambient temperature extremes: 15 - 140 degrees Fahrenheit (-10 - 60 degrees Celsius).
    b. Recommended ambient temperature: 64 - 77 degrees Fahrenheit (18 - 25 degrees Celsius).
    c. Relative humidity: 10 - 90% non-condensing.
    d. General conditions: Office level cleanliness. Interior use only.

11. Quantities
    a. Auditorium: Furnish and Install the following:
       1) Basis of Design:
          a) RELAY PANEL RP-1
             1)) (1) Signify/ Strand Lighting Contact Relay Panel with (36) 20AMP/ 120vAC Single Pole Relays, (36) 20amp breakers and Main Lugs Feed.
       2) Pre-Approved Alternate Products
          a) RELAY PANEL RP-1
             1)) (1) Electronic Theater Controls Echo Relay Panel with (36) 20AMP/ 120vAC Single Pole Relays, (36) 20amp breakers and Main Lugs Feed.

B. Lighting Control Panel ERP-1
1. Overview.
   a. The Lighting Control Panel shall be fully digital, designed specifically for architectural and entertainment lighting control applications. The basis of design for the Lighting Control Panel shall be SNAP as manufactured by Pathway Connectivity.
   b. The Lighting Control Panel shall be appropriately listed by a recognized NRTL for permanent installation as a recessed or pendant mounted fixture.

26 55 50 - 12  AUDITORIUM THEATRICAL                      WCPS: Boonsboro High School
LIGHTING AND RIGGING                  Auditorium & Stage Renovations
c. The Lighting Control Panel shall, at a minimum, comply with the following standards:
   2) ANSI E1.31 – 2009, Entertainment Technology – Lightweight streaming protocol for transport of DMX512 using ACN.

d. The panel shall incorporate up to (8) normally closed 1-pole relays.
e. Each relay shall be fed by a 120vac or 277vAC 2-wire + gnd circuit
f. Each relay shall have the capacity to sink or source 0-10vDC Analog Control to LED dimming drivers and 4-wire fluorescent ballasts.
   1) Each analog control channel shall be rated for a capacity of 100ma sinking current.
   2) Each analog control channel shall be rated for a capacity of 10ma sourcing current.
g. The panel shall be approved and listed for UL 924 emergency lighting applications.

2. Mechanical.
   a. The relay panel shall be a surface-mount NEMA 1 enclosure constructed from 18 gauge steel with a hinged cover.
   b. The enclosure dimensions shall be 12” W x 18”H x 6”D (305mm x 457mm x 152mm).
   c. The enclosure shall be fabricated with appropriate internal voltage barriers to provide for separate high-voltage and low-voltage compartments. The enclosure shall be provided with 3/4” conduit knockouts for low voltage and ¾”, 1” and 1-1/4” conduit knockouts for high voltage.

3. Electrical
   a. The low-voltage power supply shall be compatible with 120 or 277VAC 60Hz input. There shall be no power switch to reduce the chance of accidental shut-off.
   b. The relays shall be UL listed 30A at 277VAC and 20A at 347VAC for driver/ballast/HID loads; and, 20A tungsten at 120VAC loads. The relay shall have an18,000A SCCR at 277VAC. The relay shall be rated for 250,000 operations at 30A fully loaded.
   c. There shall be 1500-volt electrical isolation between DMX512 input and analog output sections.
   d. There shall be 2500-volt electrical isolation between analog output and AC power sections.
   e. The DMX512 input shall be capable of withstanding the application of up to 250V without damage to internal components. Input protection shall be of the self-resetting type, rated for 250V. Replaceable fuses are not acceptable.

4. Field Connections
   a. All internal field wiring connections shall be clearly labeled according to their function.
b. Connections for DMX512, control output and DC power shall be two-part, Phoenix-type screw terminal strips, capable of accepting #26 to #14 gauge solid or stranded wire. Two sets of pluggable connector blocks shall be provided for the two DMX512 headers. One set shall be screw terminal and the second set shall be IDC to enable the use of CAT5 wire for DMX512 wiring.

c. A DMX512 THRU port shall be provided to allow connection to additional equipment.

d. AC power supply connections shall be capable of accepting up to #12 gauge solid or stranded wire. A suitable terminal shall be provided for ground wire connection.

e. Relay connections shall be capable of accepting up to #10 gauge solid or stranded wire. A suitable terminal shall be provided for ground wire connection.

5. Panel Electronics, Control And Communications.
   a. The controller module shall incorporate LED indicators for DC power input, DMX512 input and processor status.
   b. The controller module shall incorporate 5 numeric displays, 6 menu LED indicators, and 4 pushbuttons to enable user configuration of: DMX512 address; DMX512 soft patch; relay threshold; and, self testing.
   c. The DMX512 address shall be selectable in one-unit increments.
   d. The controller module shall incorporate an end-of-line terminate switch.
   e. Single DMX512 control over relay and analog output pairs or full non-sequential DMX512 softpatch.
   f. Individual relays can be patched to an auxiliary override switch input.
   g. Individual analog controls can be patched to an auxiliary override switch input.
   h. Relay activation threshold shall be user-settable in 1% increments.
   i. Analog control outputs shall be capable of sourcing or sinking current.
   j. The panel controller shall be remotely discoverable and configurable via Remote Device Management (RDM).

6. Compliance
   a. The lighting control panel shall be compliant with the following standards:
      1) UL and cUL 916
      2) UL and cUL 924
      3) ANSI E1.11 DMX512-A
      4) ANSI E1.20 Remote Device Management
      5) ANSI E1.3 0-to-10V Analog Control Specification

   a. Ambient temperature extremes: 15 - 140 degrees Fahrenheit (-10 - 60 degrees Celsius).
   b. Recommended ambient temperature: 64 - 77 degrees Fahrenheit (18 - 25 degrees Celsius).
   c. Relative humidity: 10 - 90% non-condensing.
   d. General conditions: Office level cleanliness. Interior use only.

8. Quantities
a. Furnish and Install the following:
1) Basis of Design:
   a) RELAY PANEL ERP-1
      1)) Pathway Connectivity #4850-8 (8) Circuit SNAP Relay Panel with (8) 1-Pole 20amp Relays
   2) Pre-Approved Alternate Products
      a) RELAY PANEL ERP-1
      1)) Signify/ Strand Lighting #76910 Contact Relay Panel with (12) 20A Relays and #76924 UL924 Kit

2.2 DMX EMERGENCY BYPASS SYSTEM

A. Emergency Bypass Detection
1. The bypass detection kit shall be a surface mounted enclosure.
2. Emergency Bypass Detection enclosures shall support 100 to 277 volt configurations.
3. EBDK enclosures shall configured for three-phase operation.
4. The Emergency Bypass Detection Kit shall be completely pre-wired by the manufacturer.
5. The contractor shall provide input feed and control wiring.
6. All control wire connections shall be terminated via factory provided connectors.
7. The Bypass Detection Kit shall be UL and cUL Section 924 Listed for interaction with similarly listed dimming and switching panels.
8. Quantities
   a. Auditorium: Furnish and Install the following:
      1) Basis of Design:
         a) (1) Signify/ Strand Lighting Emergency Bypass Detection Kit
      2) Pre-Approved Alternate Products
         a) (1) Electronic Theater Controls Emergency Bypass Detection Kit

B. DMX Emergency Bypass Controller
1. The DMX Emergency Bypass Controller energizes special-purpose lighting presets and bypass normal lighting controls during emergency or panic situations.
2. The DMX Emergency Bypass Controller shall be capable of overriding a single universe of ANSI E1.11–2008, USITT DMX512-A control signals from “Normal” to “Bypass” when a trigger signal is detected via a two-pin trigger input.
3. The DMX Emergency Bypass Controller shall poll the bypass trigger input after a power loss and react upon start up.
4. The default or recorded sequence shall be recalled immediately on restart if the trigger is also applied at restart.
5. The DMX Emergency Bypass Controller shall be capable of recording a single DMX preset (snapshot) of 512 channels for recall during “Bypass” mode.
6. Mechanical:
a. The DMX Emergency Bypass Controller (DEBC) enclosure shall be a surface mounted enclosure constructed of 16-gauge, formed steel panels with a removable front cover.

b. The DMX Emergency Bypass Controller (DEBC) enclosure shall provide discrete high and low voltage wiring compartments with voltage barrier.

c. DEBC shall support labeled, socketed termination connections for DMX Input and DMX Output wiring.

d. Terminations shall support Belden 9729 cable or equivalent.

e. DMX Termination kits for Belden 9729 shall be supplied with the controller.

7. Electrical:
   a. The DMX Emergency Bypass Controller shall be completely internally pre-wired by the manufacturer.
   b. The contractor shall provide input feed and control wiring.
   c. The DMX Emergency Bypass Controller (DEBC) shall support one Universe (512 channels) of Digital Multiplexing (DMX) in accordance with ANSI E1.11–2008, USITT DMX512-A.
   d. The DMX Emergency Bypass Controller (DEBC) shall not process (pass-through) the normal DMX input.
   e. The DMX Emergency Bypass Controller (DEBC) shall internally switch from the normal DMX input (pass through) to the bypass DMX output using electromechanical relays when triggered.
   f. The DEBC shall have non-volatile memory for storage of a single recorded sequence of 512 channels.
   g. The recorded sequence shall persist through power outages.
   h. The DMX Emergency Bypass Controller shall be UL and cUL Section 924 Listed for interaction with similarly listed products.

8. Thermal:
   a. Ambient room temperature: 0-40°C / 32-104°
   b. Ambient humidity: 10-90% non-condensing.

9. Quantities
   a. Auditorium: Furnish and Install the following:
      1) Basis of Design:
         a) (1) Signify/ Strand Lighting DMX Emergency Bypass Controller
      2) Pre-Approved Alternate Products
         a) (1) Electronic Theater Controls DMX Emergency Bypass Controller

2.3 LIGHTING CONTROL NETWORK

A. Ethernet Signal Distribution
   1. Overview.
      a. The Lighting Control Ethernet Network shall provide data distribution over a TCP/IP Ethernet Network. Systems using proprietary formats or formats other than TCP/IP shall not be accepted.
b. The Lighting Control Ethernet Network shall, at minimum, comply with the following standards:
   1) ANSI E1.31 – 2009, Entertainment Technology – Lightweight streaming protocol for transport of DMX512 using ACN.

2. The Electrical Contractor shall furnish and install complete with all accessories an EIA/TIA 568B, Category 5e Structured Cabling Plan. The Structured Cable Plan system shall serve as a vehicle for transport of lighting control and system configuration data throughout the building from designated demarcation points to outlets located at various desk locations as indicated on the contract drawings and described herein.

3. Data pairs shall be extended between the station location and an associated distribution frame/patch panel. The cable shall consist of 4 pair 24 gauge, solid copper conductors verified to Category 5e standards. Cables shall be terminated on the RJ45 jacks provided at each outlet.

4. Installing contractors shall provide full test and certification documents on all network wiring. A wire map, Near End Cross Talk, attenuation, and the installed length shall be recorded for each cable. No horizontal cable run shall exceed 250 feet.

5. Capacities.
   a. The Network shall provide DMX512 routing and patching for no fewer than 32,768 DMX512 addresses and may be output to any node in the system. DMX512 input, routing and output shall be specifically supported on the system from multiple sources and locations.
   b. Outputs may be created from multiple overlapping sources with no fewer than 3 levels of patch priority.
   c. DMX512 data streams may consist of any range of 512 numbers from the available system capacity allowing complex number ranges to be created using "and" and "thru" command structures.

6. Operational Features.
   a. Multiple sources may be combined on any node output and a priority may be assigned to each source. Each DMX512 output on each node may have its own label and start address for ease of use.
   b. All configuration data for each Network device shall be held at the device and system operation shall not require continuous on line operation of the Network configuration software.
   c. DMX512 ports shall be configurable for either input or output.
   d. Any number of DMX512 lines may be configured with any length up to 512 addresses as long as the total does not exceed 32,768.
   e. Any range of DMX512 addresses may be selected for each feed and may be any set of 512 numbers from the total available on the network.
   f. Numbers may be selected in any order and the use of "and" plus "thru" commands shall be supported.
   g. Multiple sources may be combined on any node output and a priority may be assigned to each source.
   h. Each DMX512 output on each node may have its own label and start address for ease of use.
B. Ethernet Switches Patch Panels.
   1. Provide Ethernet switches and patch panels of a high quality from a company with (5) five or more years of experience manufacturing this equipment.
   2. All switches shall be dual speed capable of operating standard and fast Ethernet protocols.
   3. Switches shall support Power Over Ethernet on all ports compliant with the IEEE 802.3 standard
   4. Label hubs and patch panels with the locations of the field boxes.
   5. Provide proper quantity of Cat 5 patch cables to patch all field devices to hubs/switches
   6. Provide rack mounted power filtration I line regulation I battery backup unit for each hub/switch.
   7. Acceptable hub/switch manufacturers:
      a. 3-Com corporation- 5400 Bayfront Plaza Santa Clara, CA 95052-8145.
      b. Cisco Systems- 170 West Tasman Drive San Jose, California.
      c. Pathway Connectivity, Calgary Alberta

C. Lighting Control Network Rack
   1. The Equipment Rack shall be sized to hold all of the specified equipment with 20% spare capacity.
   2. The units shall be a wall mounted, swing out for easy rear access.
   3. The unit shall have a locking front panel plus one locking 4U drawer and one sliding tray.
   4. The rack shall have a power supply duplex with a dedicated 20A 120VAC power source.
   5. The Equipment Rack will house Lighting Control Network equipment required for the project and the components of the Architectural/ Preset Control System.
   6. Provide the Following:
      a. One (1) Uninterruptible Power Supply (UPS) 60min reserve for all equipment in the rack.
      b. 12 and 24 Port POE Switches as necessary to connect all equipment and systems
      c. Cable Management system to include Patch panel and patch cables to connect all equipment and ports, brush panel, etc.
      d. (1) Lot Ethernet Equipment and accessories as per contract drawings and as required for a complete and working system, even if not specifically enumerated herein.

D. Rack Mounted 8-Port DMX Gateway Node
   1. General
      a. Rack Mounted 8-Port portable DMX nodes permit DMX512 data to be encoded, routed and decoded over an Ethernet network.
      b. Each node shall also incorporate one external 10/100 Ethernet port utilizing a rear-mounted EtherCon™ RJ-45 type female jack.
d. Nodes shall incorporate a manual user interface consisting of an encoder knob with integral pushbutton and a backlit graphical LCD display for identification (soft-labeling) and status reporting. Labeling shall be user configurable.

e. Nodes shall be capable of encoding or decoding DMX data to or from any industry standard Ethernet lighting control protocol and certain commonly used proprietary Ethernet protocols.

f. The nodes shall, at a minimum, comply with the following standards:
   2) ANSI E1.31 – 2009, Entertainment Technology – Lightweight streaming protocol for transport of DMX512 using ACN.

2. DMX Ports
   a. DMX ports shall be fully electrically isolated from the network infrastructure and Ethernet power.
   b. DMX ports shall be capable of being user-configured as inputs or outputs, regardless of the connector style.

3. Processor
   a. Each node shall have sufficient processing power to merge up to eight (8) incoming DMX universes with respect to each output port.
   b. The CPU shall be capable of processing up to sixteen (16) megabits per second of network traffic without any dropped packets.
   c. Maximum delay time from input to output shall not be greater than one DMX packet time (approximately 30 mSec.).

4. Electrical
   a. The power supply shall be a field-replaceable, wide-range input (85-264VAC, 50/60Hz) switching power supply.
   b. There shall be 4000-volt electrical isolation between mains power supply and low voltage circuits.
   c. There shall be 2500-volt electrical isolation between adjacent DMX I/O sections.

5. Configuration
   a. Node identification (naming), DMX port direction, universe patching and all other configuration shall be accomplished using a personal computer connected to the Ethernet port.
   b. DMX Routing
      1) It shall be possible for the user to route complete DMX universes from any input port to any DMX output port at any node. It shall be possible to route universes to any number of nodes.
      2) It shall further be possible to route individual DMX channels (or ranges of channels) from any input port to any output port.

6. Quantities:
   a. Auditorium: Furnish and Install the following:
      1) Basis of Design:
         a) (5) Pathway Connectivity #6402 Octo 8-Port DMX/RDM Gateway with Rear Terminal Strips
2) Pre-Approved Alternate Products
   a) (10) Electronic Theater Controls #N34G-4TERM Net3 4-Port
      DMX/RDM Gateway with 4 Terminal Strip Ports
   b) (5) Electronic Theater Controls #4260K1001 Net3 Gateway
      Rack Mount Kit suitable for mounting (2) 4-Port Gateways
      each

2.4 CIRCUIT AND DMX DISTRIBUTION

A. Connector Strips
   1. General
      a. Connector Strips shall of steel construction with distributed power
         and data receptacles as detailed on the contract drawings and
         schedules.
      b. One electrically isolated and assignable DMX output receptacle shall
         be provided at each line voltage power receptacle or pigtail.
      c. The Connector Strip shall be appropriately listed by a recognized NRTL
         for permanent installation as a recessed or pendant mounted fixture.
      d. The Connector Strip shall, at a minimum, comply with the following
         standards:
         1) ANSI E1.11 – 2008 (R2013): Entertainment Technology - USITT
            DMX512-A, Asynchronous Serial Digital Data Transmission
            Standard for Controlling Lighting Equipment and Accessories.
         2) ANSI E1.31 – 2009, Entertainment Technology – Lightweight
            streaming protocol for transport of DMX512 using ACN.
      e. TEC shall coordinate the manufacture and design of Overstage Connector
         Strips in the Auditorium with the winch design to ensure adequate payload
         capacity for the lighting battens.
   2. Physical
      a. The product shall have a Barrier between low voltage and high voltage
         areas.
      c. The product shall consist of individual panels every 3” for flush mounting
         of Power or data receptacles.
      d. The product shall employ DIN rail mounting data management devices
         The product shall be standard Flat Black in color.
      e. Standard identification of power receptacles shall be 2-inch high white
         vinyl alpha-numeric characters.
      f. Standard identification of data receptacles shall be 1-inch high white vinyl
         alpha-numeric characters.
      g. Product shall be available in custom lengths as per contract drawings.
         Lengths over 6 feet in length shall be shipped folded in sections and
         packaged for quick assembly.
   3. Power Input
      a. Circuits in the product shall be pre-wired to a junction box containing DIN
         rail mounted terminal strips for connection to line voltage feed circuits.
   4. Power Output
      a. Power receptacles shall be flush mounted PowerCon or TruPower line
         voltage power connectors.
b. Under no circumstances shall NEMA 5-15 ("Edison") or 2P&G ("Stage Pin" Connectors be used to Power LED Theatrical Lighting Fixtures.

5. Data Ports
   a. One electrically isolated and assignable DMX output receptacle shall be provided at each line voltage power receptacle or pigtail.
      1) DMX Outputs must be independent from one another and shall require no manual configuration for use or adjustment. Systems with "pass-thru" buttons requiring configuration of control receptacles are specifically rejected by this specification.
      2) Unplugging, moving, or removing a fixture or group of fixtures shall not require re-configuration of data cabling to the remaining fixtures to maintain proper operation.
      3) Data Ports shall fully support addressing, configuration, and diagnostic via RDM of connected LED and Automated Lighting Fixtures from PC’s connected at any point to the Lighting Control Network.
   b. All DMX/RDM output ports shall be capable of withstanding short-term application of up to 250V without damage to internal components.
      1) Port protection shall be self-healing, rated for 250V. Replaceable fuses shall not be acceptable.
      2) The DMX/RDM input port shall provide 1500-volt optical isolation between the input signal wiring and output signal wiring.
      3) DMX/RDM output ports shall be fully optically isolated from each other and floating with respect to earth ground.
   c. Provide (1) Isolated DMX Output per Power Output per Power Output for all Outlet Boxes
   d. One EtherCon network receptacle connected to the Lighting Control Network shall be provided per connector strip for connection of Portable Nodes and equipment.

6. Quantities
   a. Auditorium: Furnish and provide for installation by others the following:
      1) Basis of Design:
         a) Altman #450 Series Lighting Connector Strips with appropriate mounting hardware, Integrated Ethernet/ DMX Nodes, Integrated DMX/RDM Splitters, Gridiron Boxes, SO Cables, data cables, and cable management as described by contract drawings and schedules.
      2) Pre-Approved Alternate Products:
         a) Electronic Theatre Controls Connector Strips with appropriate mounting hardware, Integrated Ethernet/ DMX Nodes, Integrated DMX/RDM Splitters, Gridiron Boxes, SO Cables, data cables, and cable management as described by contract drawings and schedules.
         b) SSRC Connector Strips with appropriate mounting hardware, Integrated Ethernet/ DMX Nodes, Integrated DMX/RDM Splitters, Gridiron Boxes, SO Cables, data cables, and cable management as described by contract drawings and schedules.
B. Outlet Boxes
   1. General
      a. Outlet Boxes shall of steel construction with distributed power and data receptacles as detailed on the contract drawings and schedules.
      b. One electrically isolated and assignable DMX output receptacle shall be provided at each line voltage power receptacle or pigtail.
      c. The Outlet Boxes shall be appropriately listed by a recognized NRTL for permanent installation as a recessed or pendant mounted fixture.
      d. The Outlet Boxes shall, at a minimum, comply with the following standards:
   2. Physical
      a. The product shall be contracted of 18 gauge steel construction with 14 gauge Electro Zinc caps and joiner pieces.
      b. The product shall have a 20 gauge Electro Zinc Barrier between low voltage and high voltage areas.
      c. The product shall consist of individual panels every 3” for flush mounting of Power or data receptacles.
      d. The product shall be standard Flat Black in color.
      e. Standard identification of power receptacles shall be 2-inch high white vinyl alpha-numeric characters.
      f. Standard identification of data receptacles shall be 1-inch high white vinyl alpha-numeric characters.
      g. Product shall be available in custom configurations as per contract drawings.
   3. Power Input
      a. Circuits in the product shall be pre-wired to a junction box containing DIN rail mounted terminal strips for connection to line voltage feed circuits.
   4. Power Output
      a. Power receptacles shall be flush mounted PowerCon or TruPower line voltage power connectors.
   5. Data Ports
      a. One electrically isolated and assignable DMX output receptacle shall be provided at each line voltage power receptacle or pigtail.
         1) DMX Outputs must be independent from one another and shall require no manual configuration for use or adjustment. Systems with “pass-thru” buttons requiring configuration of control receptacles are specifically rejected by this specification.
         2) Unplugging, moving, or removing a fixture or group of fixtures shall not require re-configuration of data cabling to the remaining fixtures to maintain proper operation.
3) Data Ports shall fully support addressing, configuration, and diagnostic via RDM of connected LED and Automated Lighting Fixtures from PC’s connected at any point to the Lighting Control Network.

b. All DMX/RDM output ports shall be capable of withstanding short-term application of up to 250V without damage to internal components.
   1) Port protection shall be self-healing, rated for 250V. Replaceable fuses shall not be acceptable.
   2) The DMX/RDM input port shall provide 1500-volt optical isolation between the input signal wiring and output signal wiring.
   3) DMX/RDM output ports shall be fully optically isolated from each other and floating with respect to earth ground.

c. Provide (1) Isolated DMX Output per Power Output per Power Output for all Outlet Boxes

6. Quantities
   a. Auditorium: Furnish and provide for installation by others he following:
      1) Basis of Design:
         a) Altman Lighting #450 Outlet Boxes with appropriate mounting hardware and data distribution, as described by contract drawings and schedules.
         2) Pre-Approved Alternate Products
            a) Electronic Theatre Controls Outlet Boxes with appropriate mounting hardware and data distribution as described by contract drawings and schedules.
            b) SSRC Outlet Boxes with appropriate mounting hardware and data distribution as described by contract drawings and schedules.

C. Floor Pockets
   1. General
      a. The Floor pocket shall be a wiring device designed for flush mount installation into the floor.
      b. Terminations shall be made at each connector by the installer contractor.
      c. Floor pockets shall be supplied with back box and cover plate.
      d. The floor pocket back box shall have an integral voltage barrier for data distribution.
      e. Outlet Boxes shall of steel construction with distributed power and data receptacles as detailed on the contract drawings and schedules.
      f. One electrically isolated and assignable DMX output receptacle shall be provided per floor pocket.
      g. The Floor Pocket shall be appropriately listed by a recognized NRTL for permanent installation as a recessed or pendant mounted fixture.
      h. The Floor Pocket shall, at a minimum, comply with the following standards:
2. Physical
   a. Floor pocket covers shall be constructed of 3/8” cast iron with a non-skid tread pattern
   b. The cover shall be constructed with integral hinges and four (4) cable notches.
   c. Covers are attached to the floor using four (4) mounting holes at the corners with hardware provided by the installing contractor
   d. Floor pocket connectors shall be mounted in a connector panel fabricated of 16-gauge steel finished in a low gloss black powder coat paint
   e. The connector plate shall be attached to the floor pocket cover.
   f. Circuits shall be labeled on the connector strip with 9/16” lettering.
   g. Circuits shall be labeled using specified labeling per plans and drawings

3. Power Output
   a. Power receptacles shall be flush mounted PowerCon line voltage power connectors.

4. Data Ports
   a. One electrically isolated and assignable DMX output receptacle shall be provided per Floor Pocket

5. Quantities
   a. Auditorium: Furnish and provide for installation by others he following:
      1) Basis of Design:
         a) Altman Lighting #FP-4-XX Floor Pockets with appropriate data distribution as described by contract drawings and schedules.
      2) Pre-Approved Alternate Products
         a) Electronic Theatre Controls Floor Pockets with appropriate data distribution as described by contract drawings
         b) SSRC Floor Pockets with appropriate data distribution as described by contract drawings

2.5 ARCHITECTURAL/PRESET LIGHTING CONTROLS

A. System Overview
   1. System shall be a fully integrated digital lighting control system, utilizing digital communications between stations, and the control devices (dimmers, relays, and DMX-512 controlled equipment) in the system as required. The basis of design for the architectural/preset lighting control system shall be Vision.net Color as manufactured Signify/ Strand Lighting.
   2. The System shall control connected white light and color mixing LED luminaires as well as relays, dimmers, and Automated Luminaires.
   3. The System shall seamlessly transfer control between the Lighting Control Console and the Architectural/ Preset Control system while accurately reproducing a) recorded or b) direct control of fixture attributes including color and intensity.
   4. Presets shall be recorded as a “snapshot” of live levels produced by the Lighting Control Console and the Architectural/ Preset Control System.
5. The System shall have the ability to control all attributes of LED and Automated Luminaires via on-screen, per fixture controls.

B. General
1. Capacities.
   a. The system shall support up to 255 rooms with a maximum of 125 control channels per room, which can be connected to an unlimited number of dimmers, relays, or DMX512 controlled equipment. The control connection between stations and the dimming and relay systems shall be via standard Cat 5e cable.
   b. For the Auditorium, the system shall provide, at a minimum, point by point control of up to (2048) DMX512 fixture attributes, dimmers, or relays via Intelligent Fixture Interface Cards.
   c. TEC Shall provide multiple, integrated processors as necessary to provide complete and integrated control of up to (2048) channels/attributes of control.

2. Interconnection.
   a. Button and Slider Stations shall be connected as an RS485 serial "daisy chain" using Belden 1583A Cat 5e cable.
   b. It shall be possible to change standard control stations at any location on the data network without requiring additional wiring or alterations to the wiring specification.
   c. Touchscreen stations shall require a separate power feed to operate the station electronics.

3. Architectural/Preset Lighting Control System Configuration Interface.
   a. The system shall support a digital communications link for station configuration and set up.
   b. A Personal Computer operating The Architectural/Preset Lighting Control System Design software connected via Ethernet, RS232, or USB shall provide configuration of the Architectural/Preset Lighting Control System and data network.
   c. Designer software shall provide a graphical set up and configuration program from Windows-based personal computers.
   d. Button Functions
      1) Station and Touchscreen buttons can be programmed for the following functions:
         a) Preset.
         b) Preset/Off.
         c) Toggle.
         d) Smart.
         e) Raise.
         f) Lower.
         g) Select Map.
   e. System shall support the allocation of a name or label to every room, panel, station, preset and group in the system.
f. System shall support macros using a "Smart" button. Smart buttons shall carry out a sequence of standard system commands. It shall be possible to program Smart buttons from any control station pushbutton, remote input or, automatically using the astronomical time clock. It shall be possible to assign any of the system commands to any station pushbutton, external device input, time clock event, or Macro step.

g. In cases where an area is to be divisible for separate or combined control, it shall be possible to combine the constituent rooms either manually or with automatic partition switches. Rooms are combined using a "Room Link" touchscreen button. Rooms that are not linked shall maintain their own presets, levels and channels. "Room Link" coordinates the selection of presets within the combined rooms from any control station within those rooms.

4. Data Cable Specification.
   a. Specific Features.
      1) Control Stations Belden 1583A Cat 5 cable.
      2) DMX512 Belden 9829.

   a. For all control stations and associated equipment, the following recommendations shall apply:
      1) Ambient temperature extremes: 32° - 104° F (0° - 40° C).
      2) Recommended ambient temperature: 64° - 77° F (18° - 25° C).
      3) Relative humidity: 10% - 90% non-condensing.

C. Control Stations
   1. General
      a. The control station faceplates shall be free of visible fasteners and shall be of aesthetic appearance.
      b. Control stations shall be available in a selection of custom colors with white being the default standard.
      c. On control stations with sliders, the sliders shall have 1.75" (45mm) travel with color keyed slider knobs.
      d. Control station push buttons shall have color keyed engravable button caps with long life two color LED backlighting for active indication of a selected function or level backlighting when off or not selected.
      e. Keypads on all buttons stations shall be engravable. Keypads may be exchanged at any time to permit upgrading or changing engraving and keycap colors.
      f. Faceplates shall be die cut to precisely match any and all fader and button combinations required. Faceplate engraving shall be an available option.
      g. All control stations shall have a unique address between 1 and 255 configured at the initial system start up.
      h. A control station may consist of up to, 8 push buttons and 12 sliders for fader operation in channel control or optionally up to 12 submasters.
      i. Expansion modules shall be available to expand the capacity of any stations as required in the system design.
j. Button stations shall be available with an integral IR receiver port for a remote control of any button station.

k. Control stations require flush mounted masonry ("ears-in") back boxes, with a minimum depth of 3.5" (90mm). Back boxes must be grounded/earthed in accordance with local wiring practices to provide a discharge path to ground for static electricity.

l. Control stations shall be supplied complete with a sub-plate, which is screwed to the flush mounting back box with the screws provided. The sub-plate allows the control station to be hinged into position and secured with hexagonal setscrews on the bottom edge of the trim ring.

m. Data line terminations shall be via a screw-terminal plug and socket to facilitate removing a control station while maintaining the continuity of the data network.

D. Touchscreen Stations.

1. Specific Features.
   a. Touchscreens shall be, at a minimum, 7” full color displays. Systems that do not support color displays shall not be acceptable.
   b. Touchscreens shall support multiple tabs to allow users to organize their displays to meet a wide range of applications.
   c. Tabs shall support the following applications:
      d. Programmable Sliders that can be scaled and programmed as both channel controls and submasters.
      e. Touchscreen buttons shall be available in a variety of sizes and shapes permitting system designers the flexibility to allow buttons to define their function through shape and color.
      f. All displays, faders, buttons and tabs shall have text labels in a choice of fonts.
      g. Real Time clock display with full system programming.
   h. Portable Enclosure Kits shall enable standard stations to be converted to portable units. Kits shall be supplied complete with 25ft (8m) cable and mating connectors.

2. Programming
   a. Main Screen shall provide instant access to (5) modes of Operation:
      1) SHOW MODE shall Lock Out all Remote Stations, transfer control of House Lights and Stage Lighting to a connected sACN or DMX512A Lighting Console, activate Stage Lighting Relays (if they are not already active), turn off Work Lighting and Catwalk Lighting Circuits, and activate Blue Lighting Circuits (if present).
      2) WORK MODE shall Unlock all Remote Stations, turn the Houselights, Worklights, and Catwalk Lights to ON, turn off Blue Lighting Circuit (if Present), activate Stage Lighting Relays, and turn control of Stage Lighting over to a connected sACN or DMX512A Lighting Console. Preset and Channel Control of House Lighting shall be available.
3) **REHEARSAL MODE** shall Unlock all Remote Stations, turn the Houselights, Worklights, Blue Lights, and Catwalk Lights to ON, turn and set the Stage Lighting to OFF with Preset Control and Channel Control of Stage Lighting available.

4) **EVENT MODE** shall Lock Out all Remote Stations, activate Stage Lighting Relays (if they are not already active), turn off Work Lighting and Catwalk Lighting Circuits, activate Blue Lighting Circuits (if present), and set the Stage Lighting to PRESET 1 with Preset Control and Channel Control of Stage Lighting available.

5) **NIGHT MODE** shall Unlock all Remote Stations, turn the Houselights, Stage Lights, Worklights, and Catwalk Lights to OFF, turn ON Blue Lighting Circuit (if Present), and turn OFF House Lighting and Stage Lighting Relays.

b. There shall be a PRESET Screen accessible from all other screens. The Preset Screen shall provide (at a minimum):
   1) Recall and Playback of up to (8) House Lighting Presets
   2) Recall and Playback of up to (16) Stage Lighting Presets
   3) Password Protected Record functionality to record the Live State as either a House Lighting or Stage Lighting preset.
   4) Independent RAISE and LOWER buttons to adjust the level of the current House or Stage Lighting Preset

c. There shall be a CHANNELS Screen accessible from all other screens. The Channels Screen shall provide (at a minimum):
   1) Adjustment and Control of up to (8) Channels/ Zones of Houselighting
   2) Adjustment and Control of the intensity and color of up to (24) Zones of Stage Lighting
   3) A Master Fader for all House Lighting Channels
   4) A Master Fader for all Stage Lighting Channels
   5) A Manual Button to take Control of House Lighting Channels
   6) A Manual Button to take control of all Stage Lighting Channels
   7) Channel Faders shall reflect the current state of each Channel/ Zone when recalling Presets recorded using Levels set using Channel Faders.
   8) Houselights Channel Controls shall include On/Off Toggle Buttons for the following:
      a) House Lighting Relays
      b) Stage Lighting Relays
      c) Work Lights
      d) Catwalk Lights
      e) Blue Lights (if Present)
      f) Work, Catwalk Light, Relay, and Blue Light Levels/ States shall not be recordable into presets other than the Modes defined above.

d. There shall be a HELP Screen accessible from all other screens. The Help Screen shall provide (at a minimum):
   1) Instructions for using Modes
E. Slider with Pushbutton Stations.
1. Each station shall have a MANUAL (Take Control) button, which shall give control to the manually operated channel sliders.
2. Stations shall be available with 3, 6, 9, 12 or 15 sliders plus a proportional master. It shall be possible to allocate multiple channels within a room to a single slider.
3. Channels not allocated to a slider shall either go out or remain at the previously selected preset level when MANUAL is selected according to the configuration software.
4. Sliders may also be configured in submaster mode allowing them to operate as group masters.
5. Each preset button shall have a push and hold record function, which will allow the current slider settings to be recorded into one of the presets available from the local pushbuttons. Fade, Hold and Delay times for these presets will remain unchanged by this record action. If desired this function may be disabled when a station is configured.
6. Buttons designated as ON shall turn on House Lighting Relays (if not already ON) when activated from NIGHT MODE or other Condition when the station is unlocked, and the House Lighting Relays are OFF.
7. Buttons Designated as OFF shall turn off Houselights, but shall leave Relays ON.

F. Pushbutton Stations.
1. All button stations shall be fully configurable.
2. Smart button commands including room combine and cross room commands.
3. Each station shall store all active control information at all times.
4. All buttons shall have blue and amber backlighting LED’s. LED’s shall be fully programmable with high and low levels to indicate the status of a button and provide back lighting for all button legends.
5. Buttons designated as ON shall turn on House Lighting Relays (if not already ON) when activated from NIGHT MODE or other Condition when the station is unlocked, and the House Lighting Relays are OFF.
6. Buttons Designated as OFF shall turn off Houselights, but shall leave Relays ON.

G. Quantities
1. Auditorium: Furnish and provide for installation by others the following:
   a. Basis of Design:
      1) Signify/ Strand Lighting Vision.Net Color 5 Architectural/Preset Control System as described by contract drawings and schedules.
   b. Pre-Approved Alternate Products
      1) Electronic Theatre Controls Unison Paradigm System as described by contract drawings and schedules.
2.6  LIGHTING CONTROL CONsoles

A. Auditorium Lighting Control Console
   1. General
      a. The lighting control desk shall be a microprocessor-based system specifically designed to provide complete control of stage, studio, and entertainment lighting systems. The basis of design for the Lighting Control Console shall be the MA Dot2 XLF series as manufactured by MA Lighting.
      b. The system shall provide control of 2048 outputs on a maximum of 10,000 control channels. Output shall be distributed over a 10/100MB Ethernet network using ANSI E1.31 – 2009.
      c. The console shall be appropriately listed by a recognized NRTL for permanent installation as a recessed or pendant mounted fixture.
      d. The console shall, at a minimum, comply with the following standards:
         4) ANSI E1.31 – 2009, Entertainment Technology – Lightweight streaming protocol for transport of DMX512 using ACN.
      e. A maximum of 10,000 cues, 999 cue lists, 1000 groups, 1000 presets, 4 x 1000 palettes (Intensity, Focus, Color and Beam), 1000 effects, 1000 macros and 100 curves may be contained in non-volatile electronic memory and stored to an onboard hard drive or to any USB storage device.
      f. Recorded cue lists may be played back simultaneously on a maximum of 200 faders. Channels shall respond to cue information by last instruction with discrete rate control provided for all cues. The desk may be placed in Tracking or Cue Only mode by the user as a system default and overridden on individual record actions as required. HTP/LTP intensity flags, assert, proportional, intensity master or manual master fade control and independent status may be placed on each cue list. It shall also be possible for a cue list to contribute to playback background states or to withhold such contributions.
      g. A Master Playback fader pair and dedicated Grand Master/Blackout shall be provided.
      h. A Fader wing with (20) submasters/playback faders shall be rigidly connected to the main desk to provide a "single connected unit" with no external cables required.
      i. A high-resolution level wheel shall be provided to control intensity for selected channels and scrolling within selected displays. A high-resolution rate wheel shall also be provided.
j. Rotary encoders for non-intensity parameters shall be labeled by means of an integral LCD display mounted below the encoders on the main desk. The display shall show the currently loaded functions of the encoders based on the current selections.

k. Control and programming features for automated fixtures shall also include: a standard library of fixture profiles, the ability to copy and edit existing profiles and create new profiles, patch displays including channel and output addressing, 16-bit fade resolution, color characterization allowing color mixing and storing in Hue and Saturation or native device values.

l. System information, including playback status, live output and blind values for all record targets shall be displayed on a maximum of two external high resolution DVI monitors, or one SVGA monitor, which may also be touch-screen(s). Only one display shall be required for operation.

m. An optional, full-functioning, detachable alphanumeric keyboard shall be provided. The keyboard shall allow labeling of channels, cues, presets, groups, palettes, effects, macros, curves and the show.

n. A row of softkeys shall be provided, which change function based on the selection and context of the desk.

o. Software upgrades shall be made by the user via a USB port.

p. Show data may be created and modified on a personal computer, using either Windows XP or Windows 7 operating systems, with a free offline editing application.

q. A PC using Windows XP or Windows 7/8 or an Intel-based Macintosh computer using OS X running a client software application shall be able to connect to a control system via the network and view or modify current show data in an independent display environment.

r. Show data may be created and modified on a personal computer, using either Windows XP or Windows 7/8 operating systems.

s. The system shall support up to 32 individual Time Code Event lists.

2. Manual Control and Programming Section

a. The programming keyboard shall be grouped by function. Major groupings shall be record target functions, numeric keys, level assignment functions, display navigation functions and controls.

b. Fixtures with CMY or RBG color mixing may be set with direct CMY or RBG controls, as well as the Hue and Saturation encoders and/or color picker. Color may also be set directly to a gel match, via a graphic selection tool or from the command line.

c. Macros may be set to run as default. Default macros called manually shall post to the command line, but executed via cue lists shall run in the background.

3. Playback Section

a. The master fader shall consist of a 60mm Master Fader pair with associated Load, Go and Stop/Back buttons. Additional playback faders may be configured via the virtual fader module or on the Universal Fader Wings.
b. It shall be possible to instantaneously halt an active cue, back to the previous cue, manually override the intensity fade or manually override the entire fade.

c. It shall be possible for a cue list to contribute to the background state or for the contents of each cue list to be withheld from such.

d. The playback faders shall have the following associate controls:
   1) Freeze, which halts the output of the fader
   2) Stop Effect, which stops the action of an effect.
   3) Filter, to assign filter states to a fader
   4) Go to Cue 0, to reset a cue list.

4. Submasters
   a. It shall be possible to set submaster values directly from the command line.

5. Grand Master
   a. A dedicated grand master and blackout button are provided.
   b. The grand master shall proportionally fade intensity values to zero. Blackout shall send all intensity outputs to zero. Non-intensity outputs shall not be affected. No additional configuration shall be required to withhold non-intensity values from Grand Master and Blackout control.

6. Display Controls
   a. Format shall change the view of selected displays.
   b. It shall be possible for the user to choose which parameter categories or parameters (s)he wishes to display.
   c. Playback status displays are provided with a variety of different formats. Indications are provided per cue for live moves (lights fading from zero and also moving non-intensity parameters) and dark moves (inactive lights which have stored non-intensity parameter moves).

7. Operating Modes
   a. Live Mode
      1) Channel lists may be constructed using the +, - and Thru keys as well as the direct selects. Channel selection and deselection is fully interactive, regardless of the method used.
      2) Levels may be set with the keypad, level wheel and non-intensity encoders. “Selected” channels shall be those last addressed and under keypad control.
      3) Channels may be recorded into groups for fast recall of commonly used channels. 1000 groups shall be available. Groups shall store selection order. The Offset function supports rapid creation of ordered groups, including reverse and random order.
      4) Parameter settings may be stored to Intensity, Focus, Color and Beam Palettes and to Presets. All referenced data may be stored to whole numbers or to up to 99 decimal places between each whole number. It shall be possible to store 1000 presets and 1000 of each palette type.
5) Any collection of channel data, as determined by the use of “Record”, “Record Only, selective store commands and/or parameter filters may be stored to palettes (as appropriate to the type) and presets.

6) 999 cue lists may be stored. Cues may be recorded in any order. Up to 99 decimal cues may be inserted between any two whole number cues. Each cue may contain a maximum of twenty parts. Parameters may be automatically assigned to specific parts or assigned when the part is created.

7) It shall be possible to record cues and cue parts
8) Update may be used to selectively add modified parameter data quickly to that parameter’s current source.

9) Recall From quickly pulls specified data from record targets or other channels into the current view. Recall from on an HTP basis shall be provided.

10) Copy To quickly copies selected data to specified channels or other record targets.
11) Address and channel check functions shall be provided.
12) Undo shall be used to sequentially step back through manual operations, record, update and delete actions. Redo functions shall be provided. Multiple undo commands may be executed at once.

13) Home shall set selected channels non-intensity parameters to their default values. User definable home, on a per-channel/per-parameter basis shall be provided.

14) Move shall allow all show data to be moved from one record target to another.

15) Query shall allow selection of channels by their current or possible state. Keywords and fixture types shall allow quick access to fixtures.

8. Blind
a. The Blind display allows viewing and modification of all record targets without affecting stage levels.

b. Changes made in blind displays shall be automatically stored.

c. Blind editing shall be possible for all record targets.

d. Selection of what parameter data to view for blind editing shall be user configurable.

9. Patch Display
a. Patch shall be used to display and modify the system control channels with their associated library data.

b. Each channel may be provided with a proportional patch level, preheat, curve, label, swap and invert functions.

c. Offset functions in patch shall allow selection of channel ranges and shall allow the user to establish a “custom” footprint for any device output.

d. A full library of profiles is provided, with the ability for the user to define “favorites” for fast selection.
e. Custom color wheels, color scrolls and gobo wheels shall be defined in patch. These devices shall be created with a simple table and graphical user interface supported by images of major manufacturers.
f. Copy to and Move functions shall be supported in patch.
g. RDM discovery and device monitoring shall be supported.

10. Setup/Browser
   a. Setup shall access system, show and desk configurations.
   b. The browser shall access show data storage, import, export, print to .pdf and clear functions, as well as show data utilities.
   c. It shall be possible to partially merge show files. Users shall be able to select as much or as little of the show file as required, with renumber tools.

11. Interface Options
   a. The unit shall support a variety of local interfaces.
      1) AC input.
      2) USB (for connecting devices such as an alphanumeric keyboard, mouse, touch screens, USB Flash drive, etc.)
      3) Ethernet (one port) 802.3af compliant
      4) 1280x1024 resolution minimum.
      5) Support for a combination of (2) on-board Touch Screens and (1) Outboard Touch Screen or (2) outboard Touch Screens
      6) Two DMX512-A/RDM Ports

12. Quantities
   a. Auditorium: Provide the following:
      1) (1) MA lighting #120212 dot2 XL-F Console including (3) integrated Touch Screens, (14) Faders, (28) Buttons, and (4096) Channels including Dust Cover.
      2) (1) 22-inch Multi-Touch Touch Screen
      3) (1) Alphanumeric Keyboard
      4) (1) Mouse
      5) (2) LED Worklights
      6) (1) 25’ Ethernet Cable
      7) (1) 600va UPS
   b. Pre-approved Alternate Products
      1) (1) Electronic Theater Controls #IONXO-20 Ion XE Console, 2048 Outputs with console cover for board and wings
      2) (1) Electronic Theater Controls #FADW 2x10 Fader Wing, 2x10
      3) (2) 22-Inch Multi-Touch Display/Monitor (touchscreen)
      4) (1) Alphanumeric Keyboard
      5) (1) Mouse
      6) (2) LED Worklights
      7) (1) 25’ Ethernet Cable
      8) (1) 600va UPS

2.7 THEATRICAL LIGHTING FIXTURES AND ACCESSORIES

A. Color Mixing Light Emitting Diode Profile Luminaire
   1. General
a. The luminaire shall be a color-mixing high-intensity LED profile spotlight with 8 or 16 bit DMX control of intensity and color. The basis of design for this luminaire shall be the Phoenix LED RGBW as manufactured by Altman Lighting.

b. The luminaire shall be appropriately listed by a recognized NRTL for stage and studio use.

c. The luminaire shall, at a minimum, comply with the following standards:

d. The unit shall be constructed of rugged, die cast aluminum, free of burrs and pits, and high impact plastic, finished in black. Normal operation of the luminaire shall not require tools.

e. The following shall be provided:
   1) Lens secured with silicone shock mounts
   2) Shutter assembly shall allow for full 360 degree rotation
   3) Four tool free heavy gauge stainless steel shutters equipped with oversized insulated handles.
   4) Interchangeable lens tubes for different field angles with Teflon guides for smooth tube movement
   5) Sturdy integral die cast gel frame holders with two accessory slots, and a top-mounted, quick release gel frame retainer
   6) Rugged steel yoke with two mounting positions allowing 300°+ rotation of the luminaire within the yoke
   7) Positive locking, hand operated yoke clutch
   8) Slot with sliding cover for motorized pattern devices or optional iris
   9) Power supply, cooling and electronics shall be integral to each unit.

f. The unit shall ship with:
   1) Theatrical-style hanging yoke as standard
   2) 15’ Combination Neutrik Powercon/ 5-Pin XLR DMX Data Extension Cable
      a) Power and Data Cable shall be in an integral jacket or securely banded together
      b) Power Input and Output Connectors shall be compatible and shall securely mate with connectors on both the LED Lighting fixtures and the connectors on the DMX/Power Distribution Devices.
      c) Cable Length shall be marked on both ends of the cable and shall be protected via heat shrink.
      d) TEC shall provide necessary ties or wraps to secure excess cable neatly once fixtures are installed.
   4) Cast iron C-clamp Altman #510 suitable for use on up to 2” O.D. pipe.
   5) An 18 inch safety cable.
   6) SFLA Soft Focus Lens Accessory
2. Optical
   a. The unit shall provide, but not be limited to:
      1) Low gate and beam temperature
      2) Sharp imaging through a three-plane shutter design
      3) The unit shall provide, but not be limited to:
      4) 5, 10, 14, 19, 26, 36, and 50 degree field angles
      5) High-quality pattern imaging
      6) Sharp shutter cuts without halation
      7) Shutter warping and burnout in normal use shall be unacceptable
      8) Adjustable hard and soft beam edges

3. Thermal
   a. Luminaire shall be equipped with a variable speed cooling fan.
   b. The luminaire shall utilize advanced thermal management systems to
      maintain LED life to an average of 70% intensity after 50,000 hours of
      use
   c. The luminaire shall operate in an ambient temperature range of -10°C
      (14°F) minimum, to 40° C (104°F) maximum ambient temperature.

4. Electrical
   a. The luminaire shall be equipped with a 100V to 240V 50/60Hz internal
      power supply
   b. The luminaire shall support power in and thru operation
   c. Power in shall be via Neutrik® PowerCon™ input connector
   d. Power thru shall be via Neutrik ® PowerCon ™ output connector
   e. Luminaire power wiring and accessory power cables shall be rated to
      support linking of multiple luminaires up to the capacity of a 15A breaker
   f. The luminaire requires power from a non-dim source

5. LED Emitters
   a. The luminaire shall utilize Red, Green, Blue, and Warm White LEDs for
      a wide variety of color mixing options and selectable CRI.
   b. All LEDs used in the luminaire shall be high brightness and proven quality
      from established and reputable LED manufacturers.
   c. Manufacturer of LED emitters shall utilize an advanced production LED
      binning process to maintain color consistency.
   d. LED emitters should be rated for nominal 50,000-hour LED life to 70%
      intensity in the highest output mode available via configuration of the
      Luminaire
      1) Pre-approved alternate products with a rating less than 50,000 hours
         to 70% intensity shall provide additional light engine bodies as
         enumerated in this specification.
      2) Fixtures that offer 20,000-hour LED Life to 70% intensity in a user-
         configurable “Boost” mode and a longer LED life in a more
         conservative mode shall be considered to have a 20,000-hour LED
         life by this specification.
   e. LED system shall comply with all relevant patents

6. Calibration
   a. Luminaire shall be calibrated at factory to achieve consistent color and
      intensity output between luminaires.
7. Color
   a. The luminaire shall be provided with a 4-Color (Red, Blue, Green, and Warm White) color mixing system to achieve full spectrum color rendition and excellent CRI.
   b. The luminaire shall be equipped with an LED system compatible with standard 8-bit or user selectable 16-bit control for full range high-resolution dimming.
   c. The luminaire shall be optimized for low saturate colors (pastels) as well as high saturate colors used in theatrical applications. Luminaires utilizing 3-color (Red, Green, and Blue) mixing systems shall not be accepted.

8. Dimming
   a. The LED system shall use 16-bit nonlinear scaling techniques for high-resolution dimming.
   b. Luminaire shall provide full range (0-100%) dimming without exhibiting flicker or stepping. Dimming curves shall be optimized for smooth dimming at low intensities and over longer timed fades.
   c. The LED system shall be digitally driven using high-speed pulse width modulation (PWM)
   d. The luminaire shall have an available “smoothing” mode which makes PWM control of LED levels imperceptible to video cameras and related broadcast equipment.

9. Control and User interface
   a. The luminaire shall be compliant with the ANSI E1.11 – 2008 (R2013) standard via In and Thru 5-pin XLR connectors
   b. The luminaire shall be equipped with multi-line LCD display and navigation buttons for configuration.

10. Quantities
    a. Auditorium: Furnish and Install the following:
       1) Basis of Design:
          a) (6) Altman #PHX2-RGBW-19-B 250 watt 19deg LED Phoenix Profile Luminaire with c-clamp, color frame, and safety cable.
          b) (12) Altman #PHX2-RGBW-26-B 250 watt 26deg LED Phoenix Profile Luminaire with c-clamp, color frame, and safety cable.
          c) (9) Altman #PHX2-RGBW-36-B 250 watt 36deg LED Phoenix Profile Luminaire with c-clamp, color frame, and safety cable.
       2) Pre-Approved Alternate Products: Approval is for ETC Source4 LED Series2 Product Only. ColorSource Products shall be rejected without review as they do not meet the standard of output and quality established by this specification.
          a) (42) Electronic Theater Controls #S4LEDS2LS-0 Source Four LED Series 2 Lustr w/shutter barrel, black with c-clamp, color frame, and safety cable.
b) (6) Electronic Theater Controls #419EDLT – 19deg lens tube for Source Four LED.

c) (12) Electronic Theater Controls #426EDLT – 26deg lens tube for Source Four LED.

d) (9) Electronic Theater Controls #436EDLT – 36deg lens tube for Source Four LED.

c. Accessories: Furnish the following to the Owner:
   1) Basis of Design:
      a) (24) Altman #PHX-PH – Pattern holder for Phoenix Luminaire.

2) Pre-Approved Alternate Products
   a) (24) Electronic Theater Controls #400PH-B Pattern holder for Source Four LED

C. Color Mixing Light Emitting Diode Wash Luminaire

1. General
   a. The luminaire shall be a color-mixing high-intensity LED wash luminaire with 8 or 16 bit DMX control of intensity and color. The luminaire shall be a PAR type wash with a 15deg to 70deg zoom optic. The basis of design for this luminaire shall be the SL PAR 150 as manufactured by Signify/ Strand Lighting.

b. The luminaire shall be appropriately listed by a recognized NRTL for stage and studio use.

c. The luminaire shall, at a minimum, comply with the following standards:

d. The construction of the unit shall be sheet metal with molded engineering grade plastic in a matt black finish. Normal operation of the luminaire shall not require tools.

e. The following shall be provided:
   1) A mechanically adjustable zoom shall allow for a range of output from eight (8) to forty (40) degrees.
   2) Pre-approved alternate products that do not provide a 8deg to 40deg zoom shall provide additional lenses and lens holders as enumerated in this specification.
   3) Sturdy integral die cast gel frame holders with two accessory slots, and a top-mounted, quick release gel frame retainer
   4) The luminaire shall provide mounting capabilities from an included yoke to which approved mounting devices can be attached
   5) Power supply, cooling and electronics shall be integral to each unit.

f. The unit shall ship with:
   1) Theatrical-style hanging yoke as standard
   2) Cast iron C-clamp Altman #510 suitable for use on up to 2” O.D. pipe.
3) An 18 inch safety cable.
4) 15’ Combination Neutrik Powercon/ 5-Pin XLR DMX Data Extension Cable
   a) Power and Data Cable shall be in an integral jacket or securely banded together
   b) Power Input and Output Connectors shall be compatible and shall securely mate with connectors on both the LED Lighting fixtures and the connectors on the DMX/Power Distribution Devices.
   c) Cable Length shall be marked on both ends of the cable and shall be protected via heat shrink.
   d) TEC shall provide necessary ties or wraps to secure excess cable neatly once fixtures are installed.

2. Thermal
   a. Luminaire shall be equipped with a variable speed cooling fan.
   b. The luminaire shall utilize advanced thermal management systems to maintain LED life to an average of 70% intensity after 50,000 hours of use
   c. The luminaire shall operate in an ambient temperature range of 0°C (32°F) minimum, to 50° C (122°F) maximum ambient temperature.

3. Electrical
   a. The luminaire shall be equipped with a 100V to 240V 50/60Hz internal power supply
   b. The luminaire shall support power in and thru operation
   c. Power in shall be via Neutrik® PowerCon™ input connector
   d. Power thru shall be via Neutrik® PowerCon™ output connector
   e. Luminaire power wiring and accessory power cables shall be rated to support linking of multiple luminaires up to the capacity of a 15A breaker
   f. The luminaire requires power from a non-dim source

4. LED Emitters
   a. The luminaire shall utilize Red, Green, Blue, and White LEDs for a wide variety of color mixing options and selectable CRI.
   b. All LEDs used in the luminaire shall be high brightness and proven quality from established and reputable LED manufacturers.
   c. Manufacturer of LED emitters shall utilize an advanced production LED binning process to maintain color consistency.
   d. LED emitters should be rated for nominal 50,000-hour LED life to 70% intensity
   e. LED system shall comply with all relevant patents

5. Calibration
   a. Luminaire shall be calibrated at factory to achieve consistent color and intensity output between luminaires.

6. Color
   a. The luminaire shall be provided with a 4-Color (Red, Blue, Green, and White) color mixing system to achieve full spectrum color rendition and excellent CRI.
b. The luminaire shall be equipped with an LED system compatible with standard 8-bit or user selectable 16-bit control for full range high-resolution dimming.

c. The luminaire shall be optimized for low saturate colors (pastels) as well as high saturate colors used in theatrical applications. Luminaires utilizing 3-color (Red, Green, and Blue) mixing systems shall not be accepted.

7. Dimming
   a. The LED system shall use 16-bit nonlinear scaling techniques for high-resolution dimming.
   b. Luminaire shall provide full range (0-100%) dimming without exhibiting flicker or stepping. Dimming curves shall be optimized for smooth dimming at low intensities and over longer timed fades.
   c. The LED system shall be digitally driven using high-speed pulse width modulation (PWM)
   d. The luminaire shall have an available “smoothing” mode which makes PWM control of LED levels imperceptible to video cameras and related broadcast equipment.

8. Control and User interface
   a. The luminaire shall be compliant with the ANSI E1.11 – 2008 (R2013) standard via In and Thru 5-pin XLR connectors
   b. The luminaire shall be equipped with multi-line LCD display and navigation buttons for configuration.

9. Quantities
   a. Auditorium: Furnish and Install the following:
      1) Basis of Design:
         a) (64) Signify/ Strand Lighting #SLPAR155 LED 8deg to 40deg Wash Luminaire with c-clamp and safety cable.
         b) (64) Signify/ Strand Lighting #SLPAR155-BD 4-Way Barn Door for SLPAR155 with safety cable.
      2) Pre-Approved Alternate Products: Approval is for Altman AP-150 Color Mixing LED Par with integrated Zoom. Fixtures without integrated Zoom shall not be acceptable for this project.
         a) (64) Altman #AP-150 LED RGBW Luminaire with c-clamp and safety cable.
         b) (64) Altman #AP150BD-BK 4-Way Barn Door for AP-150 Par (provide with safety cable).

E. Color Mixing Light Emitting Diode Automated Profile Luminaire
   1. General
      a. The luminaire shall be a color-mixing high-intensity LED profile spotlight with 8 or 16 bit DMX control of intensity and color. The basis of design for this luminaire shall be the VARI-LITE VL2600 PROFILE Luminaire as manufactured by Signify/ Strand Lighting. The Luminaire shall include, at a minimum, the following features:
         1) (4) Framing Shutters with (2) independent controls per shutter and rotating shutter gate.
2) Rotating Gobo Wheel with (7) interchangeable Gobos + open
3) Fixed Gobo Wheel with (8) interchangeable Gobos + open
4) 16-Bit CMY Color Mixing and Variable CTO
5) Variable Frost
6) 0-100% Electronic Dimming
7) 16-Bit Pan and Tilt
8) Variable Zoom
9) Iris
10) Variable Speed Fan
11) 3-Facet Prism
12) LED emitters should be rated for nominal 50,000-hour LED life to 70% intensity

b. The luminaire shall conform to USITT DMX-512A(RDM) protocol standards.

c. The luminaire shall employ one (1) LED light source engine that will not emit light in the ultra-violet (wavelengths less than 380nm for UV-A, B, or C) or the Infrared spectrum (wavelengths of more than 800 nm). Units that emit light within this spectrum shall not be accepted.

d. The luminaire shall have an integrated control system that provides local controls offering access to set up parameters, reset functions, calibration functions, pre-programmed chase, and status reporting.

e. The luminaire shall be a motorized spot with a variable motorized seven (7) to forty-eight (48) degree homogenized output.

f. The luminaire shall have an output of up to 19,000 lumens.

g. The luminaire shall have control inputs for:
   1) DMX512 with input/output connectivity via a 5 Pin DMX connector
   2) RDM with input/output connectivity via a 5 Pin DMX connector

h. All control and power input and output sockets shall be located on the opposite side of the control panel to aid in cable management.

i. The luminaire shall be supplied with a limited two-year warranty when used in normal applications.

2. Physical

a. The construction of the luminaire shall be sheet metal with molded engineering grade plastic in a matt black finish.

b. The luminaire shall provide mounting capabilities from a pair of quick connect brackets to which approved mounting devices can be attached. It shall be possible to remove the quick connect brackets without the use of tools. The luminaire shall have four feet constructed from rubber for floor mounting.

c. A safety cable attachment point shall be located on the base of the luminaire.

d. The finish shall be black.

3. Mechanical

a. Variable fans shall be used to provide forced-air cooling for internal components with variable fan control via DMX.
b. A full color LCD menu system shall provide essential system information and operational controls. The LCD display shall automatically orient the display according to the orientation of the unit, thus ensuring the menu is readable in various configurations.

c. The luminaire shall have a separate control channel parameter. It shall be possible to individually reset the color system, pan and tilt, framing shutter system, and prism and frost as well as set the fan speed.

d. The luminaire shall have a motorized pan and tilt system comprising a pair of two phase stepper motors. The luminaire shall have a pan range of 540 degrees, a tilt range of 270 degrees, and 0.014 degree resolution per step. Pan/ Tilt Speed shall be not less than 3.4s/ 2.5s at maximum velocity.

e. The luminaire shall be a motorized spot with a variable motorized seven (7) to forty-eight (48) degree homogenized output.

f. The luminaire shall have a color mixing system comprising of Cyan, Magenta and Yellow coated dichroic glass flags.

g. The luminaire shall have a separate color wheel consisting of seven (7) colors + open. It shall be possible to select a color wheel position between two (2) colors to create a split color effect.

h. The luminaire shall have a separate CTO (3200K) flag. It shall be possible to operate this independently of the color mixing system and color wheel.

i. The luminaire shall have a rotating gobo wheel consisting of six (7) dichroic glass images + open. It shall be possible to rotate each image clockwise or counter clockwise continuously, or alternatively rotate to an indexable fixed position. It shall be possible to shake each image in the beam.

j. The luminaire shall have a fixed gobo wheel consisting of nine (8) images + open. It shall be possible to shake each image in the beam.

k. The luminaire shall have a three (3) facet prism to split the beam in a circular fashion. It shall be possible to rotate the prism clockwise or counter clockwise continuously, or alternatively rotate to an indexable fixed position.

l. The luminaire shall have a separate frost flag

m. The luminaire shall have an iris. It shall be possible to pulse the iris from open to close by selecting a fixed value from the iris control parameter.

n. The luminaire shall have a framing shutter system. The framing shutter system shall comprise four (4) blades, each on a separate plane. It shall be possible to control each side of each blade independently. It shall be possible to rotate the framing shutter gate ninety (90) degrees either side of horizontal. It shall be possible to select one of sixteen (16) blade macro effects from a separate blade effect control parameter.

o. There shall be separate timing control parameters for the framing shutter system, pan and tilt movement, and the CMY color mixing system.

p. The luminaire shall have a separate auto focus control parameter to provide a hard focus at seven and a half (7.5) m throw distance or fifteen (15) m throw distance.
a. Supply Voltage shall be 120 to 240V, 50/60Hz. (+/- 10% auto-ranging)
b. The luminaire current draw shall not exceed 820 watts.
c. The power input and thru connectors shall be the Powercon TrueOne to ensure safe power disconnection while under load.
d. The light source shall consist of one (1) five-hundred fifty (550) watt fixed white LED engine.
e. The luminaire shall be ETL and cETL listed, CE and C-Tick marked.

5. Environmental
a. Maximum operating ambient temperature shall not exceed 104 degrees Fahrenheit (40 degrees Celsius)
b. A variable speed cooling system shall be employed to maintain the optimal operating temperature of the luminaire.
c. Luminaires shall be low maintenance and environmentally friendly, all units shall be mercury free.

6. Operation
a. The luminaire shall include an onboard LCD display and control of the following:
   1) Function (Auto-programs and DMX addressing)
   2) Information (Fixture status information and software version)
   3) Personality (Pan/Tilt, Fan and Display settings, selection of DMX input)
   4) Reset (Recalibration options)
   5) Effect Adjust (manual selection of fixture parameters)
b. The luminaire shall provide temperature monitoring technology.
   1) The current temperature shall be readable in the menu system under Information.
   2) It shall be possible to display the temperature information in Celsius or Fahrenheit.
c. The luminaire shall include one (1) Fixed White LED engine delivering full field dimming - allowing for both smooth timed fades and fast blackouts.

7. Dimming
a. The luminaire shall use 16-bit nonlinear scaling techniques for high-resolution dimming.
   1) Multiple Dimming curves shall be selectable via the DMX Dimmer Mode parameter.
   2) The luminaire shall be digitally driven using high-speed pulse width modulations (PWM) in concert with power factor control (PFC) to ensure a smooth flicker free dimming curve from 100 to 0 % and shall be imperceptible to video cameras and video related devices.

8. Included Accessories
a. The unit shall ship with:
   1) Manufacturer’s Standard Mounting Brackets and hardware
   2) ½ Coupler Equivalent to Light Source Mega Claw suitable for use on up to 2” O.D. pipe.
   3) An 18 inch safety cable.
4) 15’ Combination Neutrik Powercon/ 5-Pin XLR DMX Data Extension Cable
   a) Power and Data Cable shall be in an integral jacket or securely banded together
   b) Power Input and Output Connectors shall be compatible and shall securely mate with connectors on both the LED Lighting fixtures and the connectors on the DMX/Power Distribution Devices.
   c) Cable Length shall be marked on both ends of the cable and shall be protected via heat shrink.
   d) TEC shall provide necessary ties or wraps to secure excess cable neatly once fixtures are installed.

9. Quantities
   a. Auditorium: Furnish and Install the following:
      1) Basis of Design:
         a) (6) Signify/ Strand Lighting # VARI-LITE VL2600 PROFILE Automated Profile Spotlight with framing shutters
      2) Pre-Approved Alternate Products:
         a) (6) Electronic Theater Controls/ High End Systems #SolaFrame 1000 Theatre Automated Profile Spotlight with framing shutters. Fixture to be provided with a Gobo in every available slot on the fixture.

F. Color Mixing Light Emitting Diode Cyclorama Luminaire
1. General
   a. The luminaire shall be a compact, lightweight color-mixing LED asymmetrical wash luminaire with 8 or 16 bit DMX control of intensity and color. The basis of design for this luminaire shall be the Spectra-Cyc 200 RGBA as manufactured by Altman Lighting.
   b. The luminaire shall be appropriately listed by a recognized NRTL for stage and studio use
   c. The luminaire shall, at a minimum, comply with the following standards:
   d. The luminaire shall incorporate a state of the art microprocessor-controlled solid-state LED light engine incorporating high power Red, Green, Blue, and Amber color LEDs, and an on-board power supply

2. Physical
   a. The luminaire shall be constructed of 18-gauge steel. Construction shall employ all corrosion-resistant materials and hardware and shall be free of pits and burrs.
   b. Standard Finish shall be Epoxy Sandtex black, electrostatic application. The luminaire shall be available with optional white, gray, and custom color finishes as specified.
c. Power supply, cooling and electronics shall be integral to each unit.
d. The housing shall serve as a convection chimney when installed in a vertical or horizontal orientation to provide for convection cooling of the LED array, integral driver, and integral power supply.
e. The luminaire shall provide even asymmetrical distribution of light on a vertical or horizontal surface by use of a blended linear LED source and a hammertone asymmetrical reflector. Luminaires that do not utilize an asymmetrical reflector must provide sufficient and appropriate spread lenses to approximate an asymmetrical distribution of light.
f. An optional rigid flat steel yoke with locking dog tilt handle shall be available for overhead pipe mounting.
g. Pipe mounted luminaires shall be supplied with a cast iron C-clamp Altman #510 suitable for use on up to 2” O.D. pipe. Luminaires shall be supplied with safety cable for use when securing the luminaire to a pipe.
h. The luminaire shall be designed to provide flat and even coverage of light when placed 4’ away from the surface being lit, 6’ on center. There shall be no visible dip in coverage or “scalloping” between luminaires when so placed.

3. Environmental
   a. The luminaire shall operate in an ambient temperature range of 1°C minimum, to 40°C (104°F) maximum ambient temperature. The luminaire shall be rated for IP-20 dry location use.
   b. The LED substrate is coupled to a highly efficient heat sink and cooling system for prolonged life of the LEDs. LED luminaire housing shall transfer heat from the LED board and associated electronics to the outside environment.

4. Electrical
   a. The luminaire shall be equipped with a 100V to 240V 50/60Hz internal power supply
   b. The luminaire shall support power in and thru operation
   c. Power in shall be via Neutrik® PowerCon™ input connector
   d. Power thru shall be via Neutrik® PowerCon™ output connector
   e. Luminaire power wiring and accessory power cables shall be rated to support linking of multiple luminaires up to the capacity of a 15A breaker
   f. The fixture shall ship with a 15’ Combination Neutrik Powercon/ 5-Pin XLR DMX Data Extension Cable
      1) Power and Data Cable shall be in an integral jacket or securely banded together
      2) Power Input and Output Connectors shall be compatible and shall securely mate with connectors on both the LED Lighting fixtures and the connectors on the DMX/Power Distribution Devices.
      3) Cable Length shall be marked on both ends of the cable and shall be protected via heat shrink.
      4) TEC shall provide necessary ties or wraps to secure excess cable neatly once fixtures are installed.
   g. The luminaire requires power from a non-dim source

5. LED Emitters
a. The luminaire shall utilize Red, Green, Blue, and White or Amber LEDs for a wide variety of color mixing options and selectable CRI.
b. All LEDs used in the luminaire shall be high brightness and proven quality from established and reputable LED manufacturers.
c. Manufacturer of LED emitters shall utilize an advanced production LED binning process to maintain color consistency.
d. LED emitters should be rated for nominal 50,000-hour LED life to 70% intensity
e. LED system shall comply with all relevant patents

6. Calibration
a. Luminaire shall be calibrated at factory to achieve consistent color and intensity output between luminaires.

7. Color
a. The luminaire shall be provided with a 4-Color (Red, Blue, Green, and Amber) color mixing system to achieve full spectrum color rendition and excellent CRI.
b. The luminaire shall be equipped with an LED system compatible with standard 8-bit or user selectable 16-bit control for full range high-resolution dimming.
c. The luminaire shall be optimized for low saturate colors (pastels) as well as high saturate colors used in theatrical applications. Luminaires utilizing 3-color (Red, Green, and Blue) mixing systems shall not be accepted.

8. Dimming
a. The LED system shall use 16-bit nonlinear scaling techniques for high-resolution dimming.
b. Luminaire shall provide full range (0-100%) dimming without exhibiting flicker or stepping. Dimming curves shall be optimized for smooth dimming at low intensities and over longer timed fades.
c. The LED system shall be digitally driven using high-speed pulse width modulation (PWM)
d. The luminaire shall have an available “smoothing” mode which makes PWM control of LED levels imperceptible to video cameras and related broadcast equipment.

9. Control and User interface
a. The luminaire shall be compliant with the ANSI E1.11 – 2008 (R2013) standard via In and Thru 5-pin XLR connectors
b. The luminaire shall be equipped with an integrated display and navigation buttons for configuration.

10. Quantities
a. Auditorium: Furnish and Install the following:
   1) Basis of Design:
      a) (7) Altman #SSCYC200-RGBA-B Spectra-Cyc Luminaire
      b) (7) Altman#SSCYC200-YOKE-B Spectra-Cyc Yoke
      c) (7) Altman#510 Pipe Clamp
      d) (7) Altman#SC-36-BK Safety Cable
2) Pre-Approved Alternate Products: Approval is for ETC Selador Lustr products only, in the configurations listed below to achieve a flat and even wash. ColorSource Products shall be rejected without review as they do not meet the standard of output and quality established by this specification.
a) (14) Electronic Theater Controls #SELLU21 Lustr Luminaire with c-clamp, color frame, and safety cable.
b) (14) Electronic Theater Controls #SELYOKE21 yoke kit for 21 inch unit with c-clamp and hardware.
c) (14) Electronic Theater Controls #400SC Safety Cable.
d) (14) Electronic Theater Controls #SELH(degree) Horizontal spread lens as recommended by luminaire manufacturer for even horizontal distribution.
e) (14) Electronic Theater Controls #SELV(degree) Vertical spread lens as recommended by luminaire manufacturer for even asymmetrical Vertical distribution.

G. Chalice 150 Recessed Downlight
1. General
   a. The luminaire shall be a full spectrum fixed white LED downlight employing a single LED emitter that is actively cooled. The Luminaire shall be the Chalice 150 down light by Altman Stage Lighting, Inc. or approved equal.
   b. The luminaire shall incorporate a state of the art microprocessor-controlled solid state LED light engine, and on-board power supply.
   c. The luminaire shall have the ability to house several different fixed white LED choices of 2700K, 3000K, 4000K, & 5000K each with CRI above 89.
   d. The luminaire’s light source shall incorporate a proprietary silent, hybrid active/convection cooling system under 19Dba at ½ meter. Any luminaire not employing a near silent light source cooling shall not be accepted.
   e. The luminaire shall utilize a high efficiency reflector system to determine beam angle with Seven (7) different choices.
   f. IES Photometric files shall be available upon request from the manufacturer to model light output using the industry standard design software.
   g. For DMX controlled models: The luminaire shall comply with USITT DMX-512 A and RDM ANSI E1.20 Standards.
   h. For Mains Dimmable models: The luminaire shall be able to be controlled from a phase cut dimming system in either forward or reverse phase (leading or trailing edge) and shall not require additional power sources for capacitance voltage control.
   i. The luminaire shall be constructed of a spun aluminum housing with steel fittings and attachment components, all free of pits and burrs.
   j. Standard finish shall be Epoxy Sandex White, electrostatic application. The luminaire shall be available with optional Black and additional custom color finishes available upon request.
k. Each luminaire’s power supply, cooling and electronics shall be integral to each unit.
l. The housing shall serve as a directional chimney to guide heat away from the LED array, integral driver and integral power supply.
m. The LED substrate is coupled to a highly efficient heat sink and cooling system for prolonged life of the LEDs.
n. The luminaire shall be capable of, dependent upon model: in new construction, remodel, and sloped ceiling installations. This luminaire shall have the capability for mounting either new construction or remodel units, and shall be interchangeable between the two different mounting types. Units not employing these mounting differentials shall not be accepted.

2. Electrical
a. Supply Voltage (DMX MODELS) shall be 120 to 277VAC, 50/60Hz. (+/-10% auto-ranging)
b. The DMX luminaires current draw shall not exceed 1.2 amps (120VAC) or 0.68 amps (220VAC) or 0.58 amps (277VAC) luminaires that do not meet these criteria shall not be accepted.
c. The light engine source shall be one (1) 2700K, 3000K, 4000K, or 5000K, 150 Watt LED chip.
d. The luminaire shall be cETLus listed.

3. Control
a. The DMX luminaire shall be equipped with an LED system compatible with standard 8-bit input, utilizing PWM high resolution dimming.
b. The Mains Dimmable luminaire shall be equipped with an LED control system compatible with both forward and reverse phase dimming systems, utilizing a PWM high resolution dimming.
c. The luminaire shall interact seamlessly with conventional sources.
d. The luminaire shall be digitally driven using high-speed Pulse Width Modulation (PWM)
e. The DMX luminaire shall have a local control keypad with an LED display for configuration and control of:
f. DMX-512A device address
   1) Luminaire personality

4. Stand Alone operation
a. It shall be possible to lock out the control keypad on the DMX model on the luminaire to prevent accidental change in luminaire configuration. Locking and unlocking the luminaire shall be via a predefined key sequence.
b. Luminaire shall have an available “Master” function to provide control of intensity of additional luminaires on the DMX string, when applicable.
c. Luminaire shall provide full range dimming performance based upon its DMX input control signal and configuration and shall be equipped with an LED system compatible with standard 8-bit input, with high resolution dimming.
d. The luminaire shall be capable of standalone operation, activated and configured at the keypad.
5. Physical
   a. The Chalice 150 Downlight LED Light shall not exceed 12-inches in height by 6-inches in diameter and shall be able to mount to the optional remodeler ring, new construction tray, or sloped ceiling adapter.
   b. The addition of optional add on reflectors shall not protrude past the outer housing of the luminaire. Optional reflectors shall include the options for 20, 29, 39, 46, 51, 64, & 91 degrees.
   c. The construction of the unit shall be a machined aluminum, sheet metal and molded engineering grade plastic.

6. Environmental
   a. Maximum operating ambient temperature shall not exceed 104 degrees Fahrenheit (40 degrees Celsius).
   b. An Active hybrid convective cooling system shall be employed to maintain the optimal operating temperature of the luminaire’s LED and shall not exceed 19dBA at ½ meter.
   c. Luminaires shall be low maintenance and environmentally friendly, all units shall be mercury free.
   d. The unit shall be listed as a NON-IC and shall conform to listings thereof.

B. Auditorium: Furnish and Install the following:
   1. Basis of Design:  (36) Altman #CDRNC-3K-W-D-120 DMX Controlled Chalice 150 Recessed Fixtures with interconnecting DMX Cables and all necessary accessories. EC shall power and install fixtures. This contractor shall provide data terminations between these fixtures.

2.8 STAGE CURTAINS AND TRACKS

A. Stage Curtains:
   1. Fabric Types:
      a. Fabric type “A”: 25 oz. Memorable Velour, FR cotton velour, KM Fabrics, standard color to be selected
      c. Fabric type “C”: FR Cotton Seamless Leno Cloth (filled scrim), color = Grey

   2. Flame Resistance:
      a. All Polyester fabrics are woven from fibers that are inherently flame retardant for the life of the fabric. These curtains never need to be re-treated for flame retardancy.
      b. 100 percent cotton fabrics are to be chemically mill treated by an immersion process. This process lasts approximately 5 years and then shall be re-done for flame retardancy according to the requirements of the National Fire Protection Association’s NFPA #701 together with dry cleaning.
c. A Certificate of Flame Resistance is to be provided for each fabric supplied. The certificates shall be issued by the fabric manufacturer or converter. Certificates issued by the supplier or fabricator are not acceptable.
d. Each curtain is to be labeled with a permanent tag giving the flame retardancy information and providing a suggested date for testing, if applicable.

3. Fabrication:
a. General: Curtains are to be fabricated in the sizes and fabrics shown in the curtain schedule.
   1) Curtains are to be stitched with thread matching the color of the curtain using a single needle lock stitch.
   2) No less than full widths of fabric are to be used in leg curtains.
   3) All fabrics with a grain or pile shall have all strips running in the same direction.
b. Fullness: Fullness as listed in the Curtain Schedule is to be in addition to allowances for seams, side hems and turn backs.
c. Pleats: Where fullness is indicated in the Curtain Schedule, pleats shall be box type on 12 inch (305 mm) centers. Valances and borders are to have their pleats arranged to conceal the seams.
d. Top Finish:
   1) Unless noted otherwise, all curtains shall have heavy-duty polyester webbing weighing not less than 2.8 oz per yard, double stitched at the top exactly 2.75” apart and have machine set black anodized #3 grommets on one (1) foot centers of curtain without fullness or in the center of the pleat for curtains with fullness.
   2) All Borders, Legs, and Masking tabs shall have heavy-duty polyester webbing weighing not less than 2.8 oz per yard, double stitched at the top exactly 2.75” apart and have blind machine set double black anodized #3 grommets on one (1) foot centers of curtain without fullness or in the center of the pleat for curtains with fullness. The face of these curtains shall not have any through grommets or other openings visible.
e. Track-mounted curtains shall be supplied with plated wire S-hooks or CCF-2 curtain to carrier snap hooks.
f. Batten-mounted curtains are to be supplied with 36 inch (914 mm) braided #4 cotton tie lines. Tie lines shall be black or white to best match the curtains with the center line in an alternate color to aid in hanging curtains.
g. Bottom Hems:
   1) Valances and borders shall have 4 inch (102 mm) bottom hems.
   2) All full height curtains shall have 6 inch (152 mm) bottom hems complete with separate interior chain pockets filled with #8 plated jack chains. Chain pockets shall be stitched so that the chain shall ride 2 inch (51 mm) above the finished bottom edge of the curtain.
   3) Cycloramas bottom hem shall be six inches wide with an inner pocket pipe pocket.
h. Side Hems:
1) All lined traveler curtains shall have 1/2 width of face fabric turned back at the leading edge.

2) All other side hems shall be 2 inch (51 mm).

i. Lining: Lining, if required in the above listing, shall conform to the following requirements.
   1) Lining shall be in the same fullness as face fabric.
   2) Lining shall finish 2 inch (51 mm) shorter than face fabric.
   3) Lining shall be attached to the face fabric along the sides and bottom hems by 4 inch (102 mm) twill tape.

4. Furnish and install the following curtains as shown on the Contract Drawings and described in this specification:

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>PANELS</th>
<th>HEIGHT</th>
<th>WIDTH</th>
<th>FULLNESS</th>
<th>FABRIC</th>
<th>COLOR</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Valence</td>
<td>1</td>
<td>5’0”</td>
<td>41’0”</td>
<td>75%</td>
<td>A</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>Main Act</td>
<td>2</td>
<td>19’0”</td>
<td>26’6”</td>
<td>75%</td>
<td>A</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>Concert</td>
<td>2</td>
<td>20’6”</td>
<td>27’0”</td>
<td>75%</td>
<td>A</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>Grand Teaser</td>
<td>1</td>
<td>5’0”</td>
<td>37’0”</td>
<td>75%</td>
<td>A</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>Border-1</td>
<td>1</td>
<td>5’0”</td>
<td>47’0”</td>
<td>0%-FLAT</td>
<td>B</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>Border-2</td>
<td>3</td>
<td>2’0”</td>
<td>30’6”</td>
<td>0%-FLAT</td>
<td>B</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>Hard Border</td>
<td>6</td>
<td>6”</td>
<td>7’0”</td>
<td>0%-FLAT</td>
<td>B</td>
<td>Black</td>
<td>See Drawings for details</td>
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<tr>
<td>Masking Tabs</td>
<td>12</td>
<td>14’0”</td>
<td>4’0”</td>
<td>0%-FLAT</td>
<td>B</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>Legs-1</td>
<td>6</td>
<td>15’6”</td>
<td>7’0”</td>
<td>0%-FLAT</td>
<td>B</td>
<td>Black</td>
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<tr>
<td>Legs-2</td>
<td>12</td>
<td>14’0”</td>
<td>4’0”</td>
<td>0%-FLAT</td>
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<td></td>
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<tr>
<td>Rear Traveler</td>
<td>2</td>
<td>16’6”</td>
<td>24’6”</td>
<td>50%</td>
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<tr>
<td>Cyclorama</td>
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<td>30’0”</td>
<td>42’0”</td>
<td>FLAT</td>
<td>C</td>
<td>Grey</td>
<td>Fabricate for motorized roll drop</td>
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</tbody>
</table>

B. Motorized Main Act Curtain Track:
   1. ADC 500 Patriarc Curtain Track.
      a. Tracks (ADC Model 5000) shall be of 7 gauge extruded aluminum I-beam construction consisting of a center rib and top, intermediate and bottom flanges.
      b. Each Curtain Carrier (ADC Model 5001) shall be spaced on 12” centers and shall be of steel construction to include two nylon-tired ballbearing wheels rolling on two separate parallel treads.
      c. Each curtain carrier shall consist of a free-moving plated swivel to accommodate curtain snap hook.
      d. Live-End (ADC Model 5003) and Dead-End (ADC Model 5004) pulley blocks shall be equipped with 5” diameter ball-bearing wheels adequately guarded.
      e. Nylon Cable Guides (ADC Model 5058) shall be furnished for the purpose of guiding operating cable along the contour of the factory-formed curved track.
f. Operating cable (ADC Model 5029) shall be of 3/16” diameter extruded nylon with wire-center.
g. 1-1 24” I.D. stiffening pipe or the equivalent shall be used to support both straight and curved areas of all suspended curved tracks.
   1) Furnish and install two End Stops (ADC Model 5009) for placement at track.
2. ADC 2904 Curtain Draw Motor
   a. Curtain draw machines shall be fully automatic type with 3/4 HP motor connected through V-belt drive to gear unit, on the output drive shaft of which shall be mounted elevator-type grooved cable drum delivering a cable speed of 86 feet per minute equivalent to curtain separation speed of 3 feet per second.
   b. Mechanism shall include magnetic contactor to provide reversing action at any point along the travel and shall include three-button control switch stations mounted on unit and one for remote control.
   c. Control switch wiring shall be accomplished through low voltage system running from control switch on mechanism the machine’s control box to the remote control switch station.
   d. Limit switch assembly shall be mounted integrally with gear unit.
   e. Safety guard shall be provided over V-belt drive and limit switch chain drive.
   f. Machine shall be equipped with disconnect switch, and an automatic overload protective breaker.
   g. Machine shall be equipped with cable tension device.
   h. Mounting
      1) Mount curtain draw motor stage left on contractor provided shelf with the motor base at 7’0”AFF
3. Furnish and install ADC #500 Series Patriarc Curtain Track and #2904 motor as per contract drawings and this specification.

C. Concert and Rear Traveler Curtain Track:
   1. Track shall be of 14 ga (1.980 mm) galvanized construction, entirely enclosed except for the slot in the bottom. Each section of track less than 20 ft (6,096 mm) shall be in one continuous piece. Splice clamps shall be permitted for section lengths over 20 ft (6,096 mm).
   2. Carriers shall be constructed of nylon, supported from two heavy-duty polyethylene wheels held in the ball bearing by a nickel-plated steel rivet. Each carrier shall be equipped with a free-moving swivel and sufficient trim chain to accommodate a curtain S-hook. Each carrier shall have a back-pack. Rubber washers shall be provided between each back-pack and carrier to reduce noise.
   3. The Master Carrier block shall be constructed of plated steel having two cable clips to clamp the cord to the carrier. Four wheels in pairs identical to the single carrier above shall support the block.
4. Live and dead end pulleys shall be adjustable, equipped with oil-impregnated sleeve bearing wheels on adequately guarded plated steel housings. End stops at each track end and one adjustable, demountable floor pulley shall be furnished. Stretch-resistant, fiberglass center operating cord shall be 3/8 inch (9.5 mm) in diameter.

5. Track shall be rigged for bi-parting operation with a 36 inch (914.4 mm) center overlap. Hanging clamps shall be provided for suspension at 6 ft (1,829 mm) foot maximum intervals.

6. Furnish and install ADC #280 HD Curtain Track as per contract drawings and this specification.

2.9 PIPE BATTENS

A. Pipe Batten.
   1. All battens shall be 1.5 inch (38.1 mm) nominal diameter, schedule 40 pipe in lengths as shown on the drawings or Bill of Materials. All joints shall be spliced with 18 inch (457.2 mm) long sleeves with 9 inch (228.6 mm) extending into each pipe and held by two 3/8 inch (9.52 mm) hex bolts and lock nuts on each side of the joint.
   2. Each end shall be covered with a bright yellow, closed end, soft vinyl safety cap at least 4 inch (101.6 mm) in length.

B. Batten Trim Clamp:
   1. Batten trim clamps shall consist of two pipe clamps, each made of two strips of 12-gauge (2.78 mm) by 2 inch (50.8 mm) hot rolled steel formed to encompass and clamp the pipe batten to prevent its rotation. Corners shall be rounded. There shall be a 3/8 inch x 1 inch (9.52 mm x 25.4 mm) hex bolt with lock nut above and below the batten. A 5/8 inch (15.87 mm) hole in the top of one clamp half allows the attachment of cable, chain, or other fittings. The other clamp shall be fitted with a Nylon or aluminum grooved spacer with a minimum 2 inch (50.8 mm) diameter.
   2. Line adjustment shall be made by loosening the end clamp and sliding it along the batten or by adjusting the turnbuckle if so equipped.
   3. Trim clamps shall have a recommended working load of at least 700 lbs. (317.5 KG).

C. Quantities
   1. Provide Pipe Battens, Batten Trim Clamps, and necessary hardware for a complete and working system as detailed in this specification and on the Contract Drawings.

2.10 MOTORIZED TRUSS HOIST (Front of House)

A. The line shaft type hoist shall have the ability to raise and lower the specified load at the specified speed. All components shall be designed to properly support the required loads.
   1. Hoist Characteristics:
a. Speed: 20 fpm (.1 m/s) average over full travel range.
b. Hoist Capacity: 2,150lbs. (975kg).
c. Travel: up to 25 feet
d. # of Lift Lines: up to 7.
e. Lift Line Diameter: 3/16 inch (4.76 mm).

2. Construction:
   a. The integrated motor - brake - gear reducer unit and associated components, drum, shall be supported by a sturdy steel base, holding the elements of the hoist in proper alignment.
   b. A 4 inch x 4 inch (102 mm x 102 mm) rectangular steel backbone shall be provided to support the PowerLine hoist. Backbones shall be continuous, or non-continuous, to meet the specific requirements of the specific application. The backbone shall accommodate spans between mounting steel members up to 12 feet (3.65 m) with a maximum deflection of L/180.
   c. Gearmotors shall be able to mount parallel or perpendicular to the plane of the mounting steel.
   d. Lift lines shall be able to exit parallel or perpendicular to the plane of the mounting steel.

3. Gearmotor:
   a. Motor, primary brake, and gearbox shall be an integrated unit, with the first stage pinion gear mounted directly on the motor's armature shaft. No coupling shall be permitted between the motor and gear reducer.
   b. Motors shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum NEMA service factor of 1.0 for constant operation.
   c. The gear reducer shall be a combination helical/worm or helical/bevel reducer. The gear case shall be cast iron for protection against shock damage. The input and output shafts shall have double lip oil seals to prevent leaks. The gearing service factor shall be a minimum of 1.0 with a mechanical strength service factor of 1.25.

4. Primary Brake:
   a. The primary brake shall be an integral part of the motor, mounted directly on the motor's armature shaft. No couplings shall be permitted between the motor and primary brake.
   b. Brakes shall be spring applied, direct acting, electrically released, and equipped with a manual release as backup. The brake shall an AC / DC electro-magnetic unit with a minimum retarding torque equal to 200 percent of motor full load torque.
   c. The brake shall be released by energizing the coil simultaneously with the motor winding to provide fail-safe braking in case of power failure.

5. Shafts, Keys, and Couplings:
   a. Drums shall be interconnected by commercial transmission shafts with universal joints at each end. The use of solid couplings and bar, pipe, or square tubes as shafts are not permitted.
   b. Shafts shall be designed to accommodate the applied loads (including shock and bending loads) in accordance with ANSI B106.1 m, "Design of Transmission Shafting".
c. All connections shall be keyed, using keys designed to accommodate the applied loads. Keys shall be in accordance with ANSI B17.1, "Keys and Key Seats".

d. Universal joints shall accommodate the applied loads, including shock and bending loads, and shall accommodate the possible parallel and angular misalignments caused during manufacturing, assembly, and installation, as well as by structural tolerances and structural or equipment deflections.

6. Bearings:
   a. Bearings shall be selected to accommodate the applied loads and speeds with a minimum L10 life of 2,000 hours.

7. Helical Drums:
   a. Winding drums shall be designed to properly support the required loads.
   b. Drums shall be helically grooved to accept a single layer of cable accommodating the entire travel distance plus three dead wraps. The drum diameter shall meet or exceed the wire rope manufacturer's minimum recommended D/d ratio.
   c. Drum construction shall be of the all welded type, including a continuous drum shaft. Cables shall enter the drum through key slots machined from root of the cable groove through the tubing wall at a 45 degree angle and shall be retained by a Copper swage stop sleeve inserted through the end of the slot from the outside. Cables shall have a minimum of three dead wraps on the drum. In order to prevent unbalanced operation, drum assemblies that exceed 20 rpm shall be straightened to a maximum total indicated run out (T.I.R.) of 0.005 inch (0.127 mm).
   d. Each end of the drum shall be supported by either the output shaft of the gearbox or an appropriately sized bearing mounted in the side steel plate that fully captures the drum shaft.
   e. Alternate drums shall be threaded in opposite directions, to keep the batten from "walking" as its elevation changes.
   f. Side plates shall hold four keepers designed to prevent cross winding of the lift lines on the drums.
   g. Tread pressures shall not exceed allowable radial bearing pressures as specified in the Wire Rope User Manual.
   h. Drums shall have capacity for termination on either end so lift lines can come off in either direction.

8. Limit Switches:
   a. The hoist shall have four gear-driven, independently adjustable switch/cam sets. Switches shall have snap acting contacts.
   b. Rotary limit switches shall be driven directly or by roller chains. If roller chains are used, sprockets shall be pinned to prevent slipping and sized for maximum usable rotation of switch cams. The input shaft and drive chain shall be fully guarded.
   c. Switches shall be mounted to the winch base to allow for easy adjustment of the switch settings.

9. Secondary Brake:
   a. Overspeed Brake:
1) A secondary overspeed load brake shall be supplied in addition to the primary brake on the motor. This brake shall be located on the low speed output shaft of the gearbox or directly fixed to the hoist drum.

2) This brake shall be factory set to apply itself at 125 percent of the maximum rated hoist speed (50 rpm minimum). The friction lining is mechanically set against the drum to grip when the arms extend to lock into the drum and bring the hoist to a halt.

3) The overspeed brake shall not require either electricity or pressure from an external source for operation.

10. Fixed Speed Starters:
   a. Each fixed speed hoist shall be controlled by a UL508E compliant, full voltage, self-protected, reversing starter. Enclosure shall be NEMA 12 with hinged, latching cover. The interior of the starter cabinet shall be "touch safe" per IEC 60204-1 "Protection against direct contact" rules.
   b. The NEMA/IEC mechanically and electrically interlocked, reversing starter shall be sized to match the hoist motor horsepower and shall be rated for plugging and jogging. Units shall incorporate UL 508E Type 2, non-welding, positive break contactors.
   c. Overcurrent protection shall be provided by an IEC Class 10 overload. Short circuit protection shall be provided by a circuit breaker.
   d. Starters shall be wired so that operation of the normal end of travel limit switches shall only allow movement away from the limit switch. Operation of an overtravel limit switch shall open the line contactor, and shall not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.

11. Load Monitoring:
   a. Load information shall be obtained from solid state load cells mounted between the base of the hoist and the gear motor.
      1) The cell shall accommodate total hoist loads or changing loads depending on the functions included in the supplied controls.

B. Pantograph Cable Management:
   1. Pantograph shall accommodate up to (36) 12 Ga conductors and up to (2) data cables.
      a. Up to (8) 8 conductor flat cables.
         1) Maximum capacity of (12) 120 Volt, 20 amp circuits utilizing (1) 12 Ga ground conductor for every (2) 20 amp circuits.
      b. Data Cable:
         1) (3) Data cables shall be Ethernet CAT5E.
   2. Pantograph shall be constructed with a physical barrier between the power supply and data cables within the channel.
   3. The pantograph shall consist of a series powder coated aluminum channels hinged to each other to allow the entire distance of travel required by the batten, up to a 25 feet (15.8 m) fully extended length.
   4. The top arm shall be connected to a moving trolley.
5. Pantograph shall fit between lift lines spacing greater than 8 feet - 6 inch (2591 mm) and less than 11 feet - 0 inch (3353 mm).
6. Pantograph fully retracted height shall be no greater than 25 inch (635 mm) vertical.
7. Pantograph shall mount to a 1.5 inch (38 mm) schedule 40 pipe batten.
8. Pantograph shall travel at a maximum speed of 30 feet per minute (9 meters per second).
9. System includes power and data strain reliefs for top and bottom.
10. System shall include grid junction box to be installed by electrical contractor.

C. Lighting Truss
1. Aluminum Truss
   a. Truss shall be a full welded assembly constructed from 6061-T6 Aluminum
   b. Truss shall be suspended with custom steel hanging plates
2. Plates shall be bolted in-between truss sections 7’6” either side of centerline.
3. (1) Provide 23ft Section of Total Structures Element 12 truss as shown on the drawings and described in this specification.

D. Quantities
1. Basis of Design: Provide (1) JR Clancy Powerline Winch set with cable management and lighting truss as shown on Project Drawings and described by these specifications.

2.11 MOTORIZED CYCLORAMA ROLL DROP

A. Performance Requirements:
1. Capacity:
   a. Unit shall have a minimum live load capacity of (14) pounds per linear foot of Roll Tube.
   b. Example: 60ft Roll Drop shall have a minimum Live Load capacity of 840lbs.
   c. Roll tube shall have not more than 0.2” of deflection under full rated live load.
2. Adjustability:
   a. Unit shall be adjustable to rectify the roll tube’s deflection under different live loads.
   b. Range of adjustment must allow for the roll tube to maintain deflection of 0.2” or less under any load up to the unit’s maximum live load capacity.
   c. Units without adjustability of the deflection of the roll tube shall not be acceptable for this project.

B. Components:
1. Roll Tube:
   a. Shall be a 6061-T6 aluminum tube 8” in diameter minimum.
2. Roll Tube Slices (if required):
   a. Shall be machined from ASTM A36 steel.
3. Shall be sized so as to prevent slipping and/or wobble in the roll tube.
   a. Shall be pressed into the ends of the roll tube.
   b. Mechanical fasteners shall not be permitted for splice to roll tube connections.

4. Roll Tube Hubs:
   a. Shall be machined from AISI 4140 bar stock steel.
   b. Shall be pressed into the ends of the roll tube.
   c. Mechanical fasteners shall not be permitted for hub to roll tube attachment.

5. Roll Tube Shafts:
   a. Shall be machined from ASTM A193-B7 bar stock steel.
   b. Shall be pressed into each roll tube hub.
   c. Mechanical fasteners shall not be permitted for shaft to hub connections.
   d. Shall be mounted to end weldments with (2) self-aligning pillow block bearings sized appropriate to the loads and speeds of the roll drop unit.

6. End Weldments:
   a. Shall be fabricated from ASTM A36 steel, not less than ¼” thick.
   b. Shall be constructed as necessary to accept the loads imposed by the roll tube, tensioning cable, and live load.

7. Tensioning Cable:
   a. Shall be used to adjust the deflection of the roll tube.
   b. Shall be a minimum of ½” 6x19 galvanized aircraft cable.
   c. Cable shall be terminated with a method that maintains 100% of the tensile strength of the cable.
   d. Cable shall connect to the end weldment with hardware appropriate to the loads imposed, and provide the required adjustability.

8. Gearmotor:
   a. Motors, primary brakes, and gearboxes shall be an integrated unit, with the first stage pinion gear mounted directly on the motor’s armature shaft. No couplings will be permitted between the motor and gear reducer. Exceptions will be permitted only when special gearing or torque requirements cannot be met with an integrated unit.
   b. Motors shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum AGMA service factor of 1.0 for constant operation.
   c. The gear case shall be cast iron for protection against shock damage. The input and output shafts shall have double lip oil seals to prevent leaks. The gearing service factor shall be a minimum of 1.0 with a mechanical strength service factor of 1.25.

9. Primary Brake:
   a. The primary brake shall be an integral part of the motor, mounted directly on the motor’s armature shaft. No couplings will be permitted between the motor and primary brake.
   b. Brakes shall be spring applied, direct acting, electrically released, and equipped with a manual release. The brake shall be an electromagnetic unit with a minimum retarding torque equal to 125% of motor full load torque.
c. The brake shall be released by energizing the coil simultaneously with the motor winding to provide fail-safe braking in case of power failure.

10. Soft Travel Limits:
   a. The motorized roll drop control system shall provide a minimum of (2) adjustable limits via a digital encoder integral to the gearmotor.

11. Overtravel limit switch:
   a. An optical or ultrasonic proximity sensor shall be positioned within 10ft of the center of the roll tube.
   b. The sensor shall serve to sense the upper most position of the curtain on the roll tube, as well as a counter wound curtain.
   c. Operation of an overtravel limit switch shall open the line contactor, and will not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.

12. Fixed Speed Motor Starters:
   a. Each fixed speed hoist shall be controlled by a UL 580E compliant, full voltage, self-protected, reversing starter. Enclosure shall be NEMA 12 with hinged, latching cover. The interior of the starter cabinet shall be “touch safe” per IEC 204-1 “Protection against direct contact” rules.
   b. The NEMA/IEC mechanically and electrically interlocked, reversing starter shall be sized to match the hoist motor horsepower and shall be rated for plugging and jogging. Units shall incorporate UL580E Type 2, non-welding, positive break contactors.
   c. Overcurrent protection shall be provided by an IEC Class 10 overload. Short circuit protection shall be provided by a circuit breaker.
   d. Starters shall be wired so that operation of the normal end of travel limit switches shall only allow movement away from the limit switch. Operation of an overtravel limit switch shall open the line contactor, and will not allow further movement in either direction. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.

C. Quantities
   1. Basis of Design: Provide (1) Formance Industries PanaVista 3 Motorized Roll Drop as per the Project Drawings and described by these specifications.

2.12 MOTORIZED RIGGING, CONTROL SYSTEM

A. Rigging Control System:
   1. JR Clancy SceneControl

B. SceneControl Stage Machinery Console:
   1. Application: Wall Mounted Control Panel
   2. General:
      a. Operations:
         1) The console controller shall be wholly contained within a hand-held pendant with the ability to manually control up to 8 axes.
a) The system shall allow one axis to be moved at a time. The axis can be moved visually to a position (jogged). The axis can be sent to a target.

b) The axes shall be configurable for any combination of multiple types of motors ie. fixed speed or variable speed, for example.

c) Calibration for accurate positioning of any combination of multiple types of hoisting devices shall be available ie. grooved drum or yoyo, for example.

b. Architecture:
   1) Communications between all Operator Interface devices shall be performed over an Ethernet based system.
   2) Communications between Operator Interface devices and controllers shall be performed over a commercially available network protocol such as Ethernet, DeviceNet, Profinet, etc.

3. Operating Surface:
   a. Key Switch:
      1) Pendant shall have a power switch with a removable key.
   b. Operator Push Buttons:
      1) At minimum the operator shall have push buttons available for the following functions that are not part of any touchscreen.
         a) GO (illuminated). GO button acts as operator for all moves. GO button is only relevant in JOG MODE or TARGET MODE
         b) ESTOP. ESTOP button is hard wired to inputs of the ESTOP system. ESTOP shall stop all motion in the system regardless of operational mode.
   c. Hold-To-Run operation (a.k.a. Deadman):
      1) The GO button shall operate as a deadman when selected axis is not constrained by limits or targets.
         a) Motion shall begin and continue as long as the GO button is held.
         b) Motion shall stop immediately if the GO button is released.

4. Modes of Operation:
   a. Motion shall be limited to one axis at a time.
      1) JOG MODE allows operator to move individually selected axis visually within soft limits.
      2) TARGET MODE allows operator to move individually selected axis to preset target within soft limits.
         a) Each axis allows for 8 user definable presets.
   b. Configuration of axes can be performed without the use of external devices.
      1) LIMIT CONFIG allows operator to define soft limits.
         a) Each axis allows for user definable upper and lower soft limits.
         b) Each axis allows for user definable scenery offset.
         c) Limits are in addition to the user definable presets.
      2) CURR POS UPDATE allows user to update position for an axis.

5. Axis Features:
a. Any combination of up to 8 axes can be controlled.
   1) Fixed speed:
      a) Controller can be configured for fixed speed axes.
      b) Stop distance (offset) can be configured for each axis.
   2) Dual speed:
      a) Controller can be configured for dual speed axes.
         1) Slow zone can be configured for each dual speed axis.
         2) Stop distance (offset) can be configured for each axis.
      b) Controller can be configured for dual speed axes.
   3) Variable Speed:
      a) Controller can be configured to control variable speed devices.
      b) Speed parameters (Velocity, acceleration, and deceleration) can be adjusted in modes when the GO button is relevant.
      c) Speed parameters cannot be changed when an axis is in motion.
      d) Current speed shall be displayed for the selected hoist whenever the GO button is relevant.
   4) Load Monitoring:
      a) Controller shall allow user to monitor load when connected to axes equipped with load sensing hardware.
      b) Load shall be displayed for the selected hoist whenever the GO button is relevant.

6. Monitor: One each 240 by 180 backlit graphic LCD display.

7. Annunciation:
   a. CURRENT POSITION shall be displayed whenever the GO button is relevant.
   b. TARGET shall be displayed whenever the GO button is relevant.
   c. FAULT shall be displayed whenever the GO button is relevant.
      1) FAULTS shall stop motion and cannot be reset until the fault condition is relieved.
   d. STATE shall be displayed whenever the GO button is relevant.
   e. LOAD shall be displayed whenever the GO button is relevant with load sensing equipment connected.
   f. SPEED shall be displayed whenever the GO button is relevant with variable speed equipment connected.
   g. ACCELERATION shall be displayed whenever the GO button is relevant with variable speed equipment connected.
   h. DECELERATION shall be displayed whenever the GO button is relevant with variable speed equipment connected.

8. Other Features:
   a. Provide PC software for system configuration, and for creating and copying configuration files for backup.

9. Mechanical:
   a. Pendant Dimensions - 11.97 inch L x 6.29 inch W x 3.35 inch H.
   b. Power - 24VDC supplied by central cabinet.
   c. Integrated 30 feet communications and power tail.

10. Options available:

WCPS: Boonsboro High School          AUDITORIUM THEATRICAL     26 55 50 - 61
Auditorium & Stage Renovations        LIGHTING AND RIGGING
a. 1 control axis.
b. 1-4 control axes (configurable).
c. 1-8 control axes (configurable).

11. Quantities
   a. Basis of Design: provide (1) JR Clancy wall Mounted SceneControl unit with E-Stop.

2.13 DEAD HUNG RIGGING

A. General
   1. Furnish and Install dead hung Pipe Battens for all dead hung Stage Curtains and Track and Utility Battens as specified in this section and shown on the project drawings.
   2. All Pipe Battens shall be a minimum of 50ft in length or longer if required to accurately locate within the building and properly support the Stage Curtains and Track as specified in this section and shown on the drawings.

B. Pipe Battens
   1. Construction
      a. Pipe Battens shall be 1½” schedule 40 grade A, seamless pipe fabricated in the largest possible lengths without splices.
      b. Pipe Battens shall be spliced by means of .120 x 1 9/16 dia. DOM tube 18” long with 9” of tube inserted into each half of the splice.
      c. The splice tube shall be held in place by a pair of 3/8 x 2 ½” grade 5 hex head cap screws on each side of the joint.
         1) The hex head cap screws shall pass through the pipe at 90deg angle to each other.
         2) There shall be two bolts on each side of the joint spaced 1” and 8” from the joint.
         3) Alternatively, one pair of bolts on one side of the joint may be replaced with plug welds.
      d. Pipe Battens shall be straight and painted matte black.
      e. Furnish and Mechanically Install a vinyl safety-yellow batten cap, at least 3” long, onto the ends of every pipe batten.
      f. Furnish and Install four self-adhesive labels for each batten on which the rated batten load shall be indicated.

C. Performance Requirements
   1. All dead hung pipe battens shall be suspended from the building structure on hanging points no greater than 10ft centers.
   2. All dead hung pipe batten supports shall be sufficient to provide live load capacities of the following:
      a. 30lbs per linear foot uniformly distributed load
      b. 100lb concentrated point load at mid span between two support points.
   3. All hanging points for dead hung pipe battens shall, at a minimum, employ the following:
      a. Full pipe clamps with a minimum rated load capacity of 750lbs
b. 3/8” x 6” Jaw-Jaw drop forged turnbuckles with a minimum rated load of 1200lbs.
4. Trim chains, half pipe clamps, and clevis hangers shall not be acceptable for this project.

D. Quantities
1. Furnish and Mechanically Install Pipe Battens of lengths as specified herein and on the project drawings.
   a. One Double Pipe Batten as specified in this section and shown on the project drawings.

2.14 TENSIONED WIRE GRID

A. General
1. Tensioned Wire Grid shall be designed to provide a safe and resilient walking surface with light-transparent properties.
2. The wire rope tension grid shall, at a minimum, consist of:
   a. A suspended steel frame with wire rope woven in an over-and-under pattern to create a two (2) inch mesh.
   b. Terminate each length of wire rope at each end along the perimeter of the framing members.
      1) Wire rope terminations shall have a minimum breaking strength equal to or greater that the wire rope.
   c. Construct hangers of 1-1/2-inch nominal diameter (1.9-inch O.D.) Schedule 40 black iron pipe, and steel plate as necessary to meet the requirements of this specification

B. Submittals
1. Shop Drawings
   a. Submit complete fully dimensioned, large scale detailed fabrication drawings of all major components. Drawings and schedules shall show all information necessary to explain fully the design features, appearance, function, fabrication, installation, and use of system components in all phases of operation.
2. Calculations
   a. Supply calculations demonstrating compliance with performance requirements and design criteria, including analysis data. Calculations shall be signed and sealed by the qualified professional engineer, licensed in the state of Maryland responsible for their preparation.

C. Performance Requirements
1. Tensioned wire grid shall have the following working load limits:
   a. Uniformly distributed load of 20 psf, or
   b. A concentrated point load of 300lbs over (1) square foot.
   c. Deflection of the walking surface shall not exceed 2-1/2” inches
   d. Deflection of any grid frame member shall not exceed l/240
2. Grid Hangers
a. Shall be designed to support the tensioned wire grid and its working load capacity
b. Shall be designed to support accessory loads as follows:
   1) 300 lbs per hanger for lighting and accessory loads

3. Final assembly and Installation
   a. Tensioned wire grid panels shall be welded in place to hangers and other supports
   b. Other means of attachment, such as fasteners, shall not be acceptable for this project.

D. Fabrication requirements
1. Tensioned wire grid panels
   a. Frames
      1) Shall be rectangular steel tube
      2) Corners shall be fully welded with 45 degree miter joints
   b. Wire Rope
      1) Each tension wire cable shall be 1/8-inch 7x19 with a breaking strength of 2,000 lbs
      2) Secure ends of each length of wire rope with a factory-swaged stud
         a) Fittings and hardware shall conform to the wire rope manufacturer’s recommendations.
         b) All fittings shall have 100 percent of the ultimate cable strength.
      3) Provide tensioned cables on no greater than 2 inch centers
      4) Install all tensioned cables in an over-and-under-pattern to create a 2 inch on center mesh

2. Hangers
   a. Grid hangers shall be fully welded assemblies and include at a minimum
      1) 1-1/2” schedule 40 pipe
      2) 12” square support plate at grid elevation
      3) 18” of 1-1/2” schedule 40 pipe must extend below support plate

3. Perimeter Railings
   a. A continuous railing around the perimeter of the completed grid shall be provided with the following characteristics
      1) Fully welded in place to the grid hangers and or perimeter supports
      2) Fabricated with 100% infill panels comprised of expanded steel no larger than 1-1/2 #9
      3) Fabricate railing to be free of sharp edges and burrs.

4. Intermediate railings
   a. Provide (2) parallel runs of 1-1/2” schedule 40 black iron pipe as railings/hanging positions
   b. Mounting is as shown on drawings.
   c. Provide spring actuated safety gates at access points as shown on the drawings.
      1) Non-spring actuated gates shall not be acceptable for this project.

5. Ladders
   a. Provide and install (2) access ladders where shown on the drawings
1) Ladders shall provide access from mezzanine level to the grid
b. Each ladder shall have a locking door
1) Provide and install hardware to accept owner provided pad locks

6. Utility battens
a. Provide and install the following 1-1/2” schedule 40 pipe battens
   1) (5) @ 30’6”
   2) (10) @ 8’0”
b. Secure each utility batten to grid hangers with Alvin Industrial #AIS79-8 rotolock connectors

7. Finish
   a. Provide all tension wire grid system components with black semi gloss paint finish.

E. Installation
1. Install items plumb, straight, square and level in location indicated on the contract documents and as shown on approved shop drawings. Perform cutting, drilling, and fitting required for installing grid.
2. All finishes which are disturbed during shipping and installation shall be touched up to match the original.

F. Operation and Maintenance Manuals
1. Submit Operation and Maintenance manuals. The manuals shall include:
   a. Complete parts list for all equipment and telephone numbers for the authorized parts and service distributors.
   b. Instructions as to the safe operation of all equipment
   c. Recommended maintenance schedule for component parts which may need periodic replacement.
   d. Recommendations for cleaning, maintaining, and touch up of all finished surfaces.
   e. Review the manual with Owner designated personnel to demonstrate and explain the maintenance and operation of the systems.

G. Basis of Design: Furnish and Install Tensioned Wire Grid System as per Contract Drawings and this specification complete with necessary accessories.

PART 3 EXECUTION

3.1 EXAMINATION - THEATRICAL EQUIPMENT AND SYSTEMS

A. Examine areas where the Theatrical Lighting System is to be installed and to verify that conditions are satisfactory for installation and comply with manufacturer's requirements and those specified in this section.

B. Lighting controls, control devices, theatrical lighting fixtures, and accessories shall be stored in a climate controlled environment.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.
3.2 INSTALLATION - THEATRICAL EQUIPMENT AND SYSTEMS

A. Install Theatrical Lighting System in accordance with manufacturer's written instructions and with recognized industry practice to ensure that performance lighting equipment complies with all applicable NEC, ANSI, and UL/ETL standards.

3.3 FIELD QUALITY CONTROL - THEATRICAL EQUIPMENT AND SYSTEMS

A. TEC Contractor to perform the following tests or inspections. Report deficiencies to the Electrical Contractor for correction.
   1. Electrical Tests: Perform according to manufacturer's instructions. Exercise caution testing devices containing solid state components.
   2. Operational and continuity tests of switched circuits. Perform an outlet by outlet operational test of the switched circuits to determine proper wiring and exact correspondence between the relay numbers and the outlet labels.
   3. Operational tests of Ethernet runs: Test each Ethernet wiring run for proper operation in conformance with the IEEE standard. Document the length of each run.
   4. Visual and Mechanical Inspections: Include the following:
      a. Inspect each outlet, control, receptacle, fixture and other loose items of equipment for defects, physical damage, labeling, and nameplate.
      b. Exercise and perform operational tests on mechanical parts and operable devices according to manufacturer's instructions for routine functional operation.
      c. Verify proper protective device setting and fuse types and ratings.
   5. Electrical Contractor shall be fully responsible for all reasonable costs of re-testing any deficiencies found.

B. System Turn-On and Commissioning:
   1. Provide the services of a qualified service representative, employed regularly and full time by the TEC, to perform the following services:
   2. Check the installation of the Theatrical Lighting System and ensure proper operation of all equipment. Do not energize any part of the Theatrical Lighting System until the check is complete and the service representative is present to observe the tum-on procedure.
   3. Configure the Theatrical Lighting System as directed prior to system commissioning. One (1) set of changes to the initial operating configuration may be required subsequent to commissioning, to be performed in conjunction with system demonstration and instruction.
   4. Verify operation of all work light and house light luminaires. Test operation of all Architectural/ Preset Control System devices. Verify that logical operation of controls is as specified.
   5. Verify operation of all portable control and portable display devices from all associated receptacle locations.
   6. Using a DMX source, verify operation of DMX distribution network.
7. Confirm the proper operation of the ethernet lighting control network and associated devices.

3.4 DEMONSTRATION AND INSTRUCTION - THEATRICAL EQUIPMENT AND SYSTEMS

B. Demonstration and instruction shall be performed by qualified instructors provided by the TEC. Sessions shall be coordinated with Owner’s designated personnel upon a mutually agreeable schedule. Sessions shall not necessarily be contiguous or concurrent

B. Theatrical Lighting Equipment:
1. The TEC shall provide a minimum of twelve (12) hours of training in the operation of the control console, Architectural/Preset Control system, Theatrical Lighting Fixtures, House Lighting Fixtures, Work Lighting Systems, and other related equipment specified herein. These sessions shall consist of two (2) - six (6) hour sessions at times separate from the Turn-On and Commissioning of the systems.
2. Facility staff shall receive training to include, but not limited to, the following: system overview, architectural/preset system operation and function, basic lighting console operation, basic operation of theatrical lighting fixtures.
3. Maintenance staff shall receive training to include, but not limited to the following: system overview, architectural/preset system operation and function, basic lighting console operation, basic operation of theatrical lighting fixtures, lighting control network layout, basic troubleshooting, required maintenance.

3.5 INSTALLATION - THEATRICAL RIGGING EQUIPMENT AND SYSTEMS

A. The TRC shall examine all existing conditions at the job site prior to beginning installation.

B. No installation shall commence until such time as the stage area is dry and climate controlled.

C. No work shall be performed on site except under the direct supervision of an ETCP certified rigger-theater who shall supervise operations at all times.

D. Provide touch-up painting of all parts at completion of installation.

E. All turnbuckles and screw pin shackles shall be wired shut after final adjustment.
   1. Plastic ties shall NOT be acceptable for this purpose on this project.

F. Upon completion of work, remove from building site all debris, unused materials and equipment. Leave the work area in a clean and acceptable condition.

3.6 DEMONSTRATION AND CLOSEOUT - THEATRICAL RIGGING EQUIPMENT AND SYSTEMS
A. Operation and Maintenance Training
1. Provide two separate on-site training sessions of (2) hours each consisting of training with this equipment for facility maintenance personnel, and staff. Training shall include general maintenance topics in addition to general operation topics including safe operation of the equipment
   a. These sessions are to be conducted at different times and shall be scheduled at the convenience of the Owner.
   b. Provide a sign in sheet documenting the date and time each training session was completed as part of the project closeout documents.

B. Load Testing
1. In accordance with ANSI E1.6-1 – 2012: Entertainment Technology – Powered Hoist Systems each motorized hoist shall be load tested at 100% of design load after installation has been completed.
   a. This load test shall be executed under the direct supervision of an ETCP:CR-T
   b. This load test must be witnessed by a representative of either the Contractor, or the Owner.
   c. A sign off sheet documenting the load test of each hoist shall be provided and include the following information:
      1) ETCP:CR-T certification number of the supervising installer who conducted the load test
      2) Date and time of the load test.
      3) Name, Title, and Signature of the supervising installer, and witnessing representative

C. As Built Documentation
1. A full set of As Built Drawings shall be provided within thirty (30) days of completion of the work. Drawings shall be no less detailed than the project submittal drawings.
2. Provide (3) copies of the manufacturer’s operations and maintenance manuals for the motorized hoist system.
3. Electrical drawings for motorized rigging control system shall be provided inside each starter cabinet.

END OF SECTION
DIVISION 27

COMMUNICATIONS

BUSHEY FEIGHT MORIN ARCHITECTS INC.
473 NORTH POTOMAC STREET
HAGERSTOWN, MARYLAND 21740
301-733-5600 FAX: 301-733-5612
PART 1    GENERAL

1.1   RELATED DOCUMENTS

   A. Drawings and general provisions of Contract, including General and Supplementary
      Conditions and Division 1 Specification Sections, apply to this Section.

1.2   SUMMARY

   A. This Section includes identification of network materials, equipment, and
      installations in accordance with the ANSI/TIA/EIA 606A guidelines. It includes
      requirements for network identification components including but not limited to the
      following:
      1. Identification labeling for cables, and conductors.
      2. Operational instruction signs.
      3. Equipment labels and signs.

   B. Refer to Division-1 General Requirements Section, "Identification Systems" for
      equipment and system nameplates, and performance data; not work of this section.

   C. Refer to other Division 27 sections for additional specific network identification
      associated with specific items.

1.3   SUBMITTALS

   A. General: Submit the following in accordance with Conditions of Contract and
      Division 1 Specification Sections.

   B. Product Data: Manufacturer's data for each type of product specified.

   C. Schedule of identification nomenclature to be used for identification signs and
      labels.

   D. Samples of each color, lettering style, and other graphic representation required for
      identification materials; samples of labels and signs.

PART 2    PRODUCTS

2.1   MANUFACTURERS

   A. Manufacturers: Subject to compliance with requirements, provide products by the
      following (for each type marker):
      Alarm Supply Co., Inc.
      Brady, W.H. Co.
      Calpico Inc.
2.2 COMMUNICATION IDENTIFICATION PRODUCTS

A. Cable/Conductor Identification Bands:
   1. General: Provide manufacturer's standard aluminum wrap-around cable/conductor markers, of size required for proper application, and numbered to show circuit identification.

B. Equipment Labels
   1. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in sizes and thickness indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black face and white core plies (letter color) except as otherwise indicated, punched for mechanical fastening.
   2. Thickness: 1/16", for units up to 20 sq. in. or 8" length; 1/8" for larger units.

C. Lettering and Graphics
   1. General: Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of the electrical systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

D. Fasteners for Plastic-Laminated and Metal Signs

E. Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.
   1. Exception: Where specifically approved contact type permanent adhesive may be used in areas where screws cannot or should not penetrate substrate.
A. CABLING NOMENCLATURE
   1. See Drawings for details on nomenclature of cables, outlets, and termination fields.
   2. Identify cable plant following ANSI TIA/EIA-606A Standard for Administration.

B. Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.

C. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.

D. Install identification devices as indicated, in accordance with manufacturer's written instructions and requirements of NEC.

E. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.

F. Regulations: Comply with governing regulations and requests of governing authorities for the identification of electrical work.

3.2 CABLE/CONDUCTOR IDENTIFICATION

A. Apply cable/conductor identification on each cable/conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present. Match identification with marking system used on shop drawings, contract documents, and similar previously established identification for project's electrical work.

3.3 OPERATION SIGNS

A. Provide instruction signs with approved legend where instructions or explanations are needed for system or equipment operation.

3.4 INSTALLATION

A. Provide equipment identification labels of engraved plastic-laminate on each major unit of electrical equipment in building, including central or master unit of each electrical system. This includes computer systems, unless unit is specified with its own self-explanatory identification. Except as otherwise indicated, provide single line of text, with 1/2-inch-high lettering on 1-1/2-inch-high label (2-inch-high where two lines are required), white lettering in black field. Text shall match terminology and numbering of the Contract Documents and shop drawings. Apply labels for each computer system component.
B. Provide labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. SCOPE
1. This section includes the minimum product and installation requirements for the equipment and cabling infrastructure in Telecommunication Spaces and Communication Rooms.
2. Communications racks and cabinets are floor-mounted structures that hold active network equipment and cable distribution systems. Installation of communications racks and cabinets requires design approval of the floor layout. Compliance to codes and standards is required for construction, grounding and bonding, and cable deployment.
3. Minimum composition requirements and installation methods for the following:
   a. Floor Mounted Racks/Distribution Frames
   b. Back Boards
   c. Rack Mounted Shelves

1.2 SUBMITTALS

A. Product Data for each type of product specified.
B. Manufacturer’s Instructions
C. Complete Product specifications including ANSI/TIA compliance.

PART 2 PRODUCTS

2.1 COMMUNICATIONS EQUIPMENT ENCLOSURES AND HOUSINGS MANUFACTURER

A. Part numbers listed below are those of Great Lakes Case and Cabinets. Equivalent manufacturer will be acceptable for this project.

2.2 FLOOR MOUNTED RACKS

A. Free Standing Relay Racks (Standard Rack)

B. Provide one (1) rack for each of the closets indicated on the drawings.

C. When racks are located adjacent to each other, the contractor shall bolt the cabinets tight together, removing the adjacent side panels. Provide quantity of racks as indicated on the drawings.
D. Racks shall meet the following physical specifications:
1. Racks shall be manufactured from lightweight 6061-T6 aluminum alloy construction.
2. Each rack will be configured with integrated Vertical Cable Management and shall measure 19” wide by 84” in height.
3. Each Rack shall have a 15” deep base with four (4) \(\frac{3}{4}\)” bolt down holes, have double sided 12/24 tapped holes and \(\frac{625}{50}\)” standard mounting spaces.
4. Equipment mounting channels will be 6” deep and punched on the front and rear flange with the EIA-310-E Universal hole pattern to provide 45 rack-mount spaces for equipment. Each mounting space will be marked and numbered on the mounting channel.
5. The rack will be UL Listed.
6. Finish shall have a flat black powder coat finish.
7. Acceptable Manufacturers/Design Make:
   a. Great Lakes Case and Cabinets Part Number# 1984BA-5FR

2.3 EQUIPMENT RACK/CABINET ACCESSORIES
A. Grounding Bus Bars
1. Provide and install one (1) 3/16” x 3/4” isolated copper ground bar at the bottom of each equipment rack that are provided under this contract.
2. The isolated copper ground bar shall be tapped 10-32 and shall connect to the building ground system via #6 copper grounding wire.
3. Provide a #6 AWG wire suitable for grounding application.

B. Power Strips
1. Provide Two (2) Power Strip for each wall mount rack installed.
2. Power Strip shall be a 19” Rack Mount strip, with 6 rear facing outlets, surge suppression, and 15 Amp/15 ft. Power Cord, UL Listed.

PART 3 EXECUTION

3.1 INSTALLATION
A. Relay Racks
1. Assemble relay racks according to manufacturer’s instructions. Verify that equipment mounting rails are sized properly for rack-mount equipment before attaching the rack to the floor.
2. All racks must be attached to the floor in four places using appropriate floor mounting anchors. When placed over a raised floor, threaded rods should pass through the raised floor tile and be secured in the structural floor below. (Use CPI Part Number 40604-003 for concrete slab floors or 40607-001 wood floors. Raised floor support kits are also available.)
3. Racks shall be grounded to the TGB using appropriate hardware provided by the contractor. The ground will meet local code requirements and will be approved by the Authority Having Jurisdiction (AHJ).
4. In seismic areas, the rack should have additional bracing as required by building codes and the recommendations of a licensed structural engineer.
5. Ladder rack may be attached to the top of the rack to deliver cables to the rack. The rack should not be drilled to attach ladder rack. Use appropriate hardware from the ladder rack manufacturer.
6. The equipment load should be evenly distributed and uniform on the rack. Place large and heavy equipment towards the bottom of the rack. Secure all equipment to the rack with equipment mounting screws.

B. Miscellaneous Requirements
1. All cables shall be neatly “dressed out” in equipment rooms.
2. Fire stop all sleeves and conduit openings after the cable installation is complete.
3. Cable pathways shall incorporate the fire rated pathway:

C. Warranty
1. Product is warranted free of defects in material or workmanship.
2. Product is warranted to perform the intended function within design limits.

D. Grounding and Bonding
1. Copper bus provided in each Telecommunication Room.
2. Bond metallic equipment racks, conduits, cable tray, ladder racks to the ground bar.
3. All connectors and clamps shall be mechanical type made of silicon bronze.
4. Terminals shall be solderless compression type, copper long-barrel NEMA two bolt.
5. Bond the shield of shielded cable to the ground bar in communications rooms and spaces.
6. All connectors and clamps shall be mechanical type and made of silicon bronze.
7. Terminals shall be solderless compression type, copper long-barrel NEMA two bolt.
8. Provide #6 AWG conductor from the bus bar to the electrical system equipment ground.
9. Bond the ground bar in the main communication equipment room to dedicated communications equipment panel board where applicable.
10. Bond metallic equipment racks to the ground bar.
11. Bond the shield of shielded cable to the ground bar in communications rooms and spaces.

E. Preparation
1. Concrete floor should be clean and dry. Floor paint or sealants shall be applied prior to column installation. NOTE: Wet areas are not suitable for communications racks. Do not install if concrete floor is subject to flooding or moisture.
2. For installed access floor applications, remove floor tiles, stringers, and pedestals in the vicinity of construction. NOTE: Column installation may be performed before or after access floor installation.
3. Layout and mark the location of the rack series on the floor according to contract drawings. Then mark the location of the first column.
4. Place the floor template from the kit into position for the first column location.
5. Mark the hole patterns for three column locations, then remove the template.
6. Drill the holes into the concrete using the specified concrete drill bit. Drill to the proper depth according to manufacturer’s instructions. CAUTION: insufficient hole depth will cause incomplete anchor bolt engagement.
7. Clean the drilled hole pattern and mount the floor anchors. Position the column and fasten the base hand-tight to the floor using the bolts and anchor washers provided.
8. Mount the second column with bolts hand-tight and align the two columns with the bottom alignment fixture provided. Tighten the anchor bolts securely and then remove the bottom alignment fixture.
9. Mount the top plate with the screws provided and tighten using the specified tool.
10. For a second rack bay, install a third column according to steps a through f above. Install one additional column at a time to complete the series of rack bays specified in the contract documents.
11. Bond the rack series to the TGB or TMGB grounding bus bar as required using #6 AWG grounding wire.
12. Assemble the spools and gates in the desired locations, and then clip the covers into position on the columns.
13. For 4-post installations, follow the same mounting procedure, and use the spacer bracket specified to position the rear pair of columns.

F. Field Quality Control - Testing
1. Verify the rack floor locations according to contract drawings.
2. Verify grounding and bonding to applicable standards and codes.
3. All anchor bolts shall be bottomed tightly onto the anchor washers with no gaps. NOTE: A gap under the anchor bolt thrust face indicates an improper hole depth. Correct this condition by drilling to the proper depth, and re-install anchor.
PART 1 GENERAL

1.1 SUMMARY

A. SCOPE
   1. This section includes the product and installation requirements for the communications termination blocks and patch panels.
   2. This section includes minimum requirements for the following:
      a. Category 6 Patch Panels
      b. Fiber Optic Patch Panels

1.2 SUBMITTALS
A. Product Data for each type of product specified.
B. Complete Product specifications including EIA/TIA compliance.
C. Test Results and Documentation as per Section 27 15 23.

PART 2 PRODUCTS

2.1 STRUCTURED CABLEING SYSTEMS MANUFACTURER

A. Part numbers listed below are those of Hubbell premise wiring. Equivalent by Leviton or Commscope shall be acceptable for this project.

B. Copper cabling, connectors, patch cords, and termination equipment shall be manufactured, certified, and warranted by a single manufacturer.

C. Category 6 Channel and Components must meet or exceed TIA/EIA 568-B.2-1 Category 6 standards. Channel to consist of Category 6 cable, patch cords, patch panel, and jack as listed herein.

2.2 RACK MOUNT PATCH PANEL (CATEGORY 6 UTP PATCH PANELS)

A. Horizontal (station) cables will terminate on Hubbell Category 6 Patch Panels. For equal systems proposal, the termination devices must support a minimum of 200 reterminations while maintaining a contact resistance of less than 1 milliohm. For durability, the product must have silver plated contacts and support the conductor at a 45-degree angle for greater mechanical strength. The IDC must be capable of terminating 22-26 AWG and must support termination of solid or stranded conductors.

B. Category 6 rated Patch panels shall be provided at each IDF for termination of all UTP horizontal and vertical riser cables.

C. Ports shall be configured to EIA-568B wiring standards; meeting the requirements for Category 6.
D. At each IDF panel, provide one RJ-45 port for each data station outlet port and each vertical riser, plus ten percent for future expansion. Separate Patch Panels shall be provided for Data Network connections.

E. Patch panels shall be 19” rack mountable, and include paper labels for station identification. Clearly label each patch point with the location of its associated data station outlet port.

F. Patch panels for Category 6 UTP cable shall be and Hubbell Part No. HP648(2U, 48 port populated).

G. See drawings and floor plans for port quantity per closet location.

PART 3 EXECUTION

3.1 PATCH PANELS

A. Install and label as shown on drawings.

B. Install per manufacturer’s recommendations.

END OF SECTION
PART 1  GENERAL

1.1  SUMMARY

A.  Scope
1.  This section includes the product and installation requirements for Equipment and cabling infrastructure.

B.  This Section includes secure support from the building structure for network items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

C.  All supports shall utilize threaded fasteners for all connections/attachments. The use of clips or clip-on type supports is not acceptable.
1.  Minimum composition requirements and installation methods for the following:
   a.  Cable Management Hardware
   b.  Cable Supporting Devices and Hangers
   c.  Cable Tray/Ladder Rack

D.  Types of supports, anchors, sleeves and seals specified in this section include the following:
1.  Clevis hangers
2.  Riser clamps
3.  C-clamps
4.  I-beam clamps
5.  Conduit straps
6.  Round steel rods
7.  Lead expansion anchors
8.  Toggle bolts
9.  Wall and floor seals
10.  Cable / Wire Tray

1.2  QUALITY ASSURANCE

A.  All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Network & Telecommunication Department. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

B.  Supports, anchors, sleeves and seals furnished as part of factory-fabricated equipment, are specified as part of that equipment assembly in other Division-27 sections.
C. Manufacturers: Firms regularly engaged in manufacture of supporting devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 3 years.

D. Installer's Qualifications: Firm with at least 3 years of successful installation experience with projects utilizing electrical supporting device work similar to that required for this project.

E. NEC Compliance: Comply with NEC requirements as applicable to construction and installation of network supporting devices.

F. MSS Compliance: Comply with applicable MSS standard requirements pertaining to fabrication and installation practices for pipe hangers and supports.

G. NECA Compliance: Comply with National Electrical Contractors Association's "Standard of Installation" pertaining to anchors, fasteners, hangers, supports, and equipment mounting.

H. UL Compliance: Provide electrical components which are UL listed and labeled.


J. Electrical components shall be listed and labeled by ETL, CSA, or other approved, nationally recognized testing and listing agency that provides third-party certification follow-up services.

K. Materials and work specified herein shall comply with the applicable requirements of:
   1. National Electric Code (NFPA 70) including the following Articles:
   2. 318 - Cable Trays
   3. 352A - Surface Metal Raceways
   4. 352B - Surface Nonmetallic raceways
   5. 353 – Multioutlet Assembly
   6. 370 - Outlet, Device, Pull and Junction Boxes, Conduit Bodies and Fittings
   7. 645 - Information Technology Equipment
   8. 770 - Optical Fiber Cables and Raceways
   9. 800 - Communications Circuits
   10. The following Telecommunication Industry Association (TIA) standards.
       a. TIA -568 Commercial Building Telecommunications Cabling Standard
       b. TIA-569 Telecommunications Pathway and Spaces
       c. TIA-606 Administration Standard for Telecommunications Infrastructure
   11. The following BICSI guidelines
       a. BICSI Telecommunications Distribution Methods Manual (12th edition)

12. The following UL Standards:
   a. UL 5 Surface Metal Electrical Raceways and Fittings

1.3 SUBMITTALS

   A. Product Data for each type of product specified.

PART 2 PRODUCTS

2.1 SUPPORTING DEVICES

   A. Provide supporting devices of types, sizes and materials indicated; and having the following construction features:

      1. Clevis Hangers: For supporting 2" rigid metal conduit; galvanized steel; with 1/2" dia. hole for round steel rod; approximately 54 pounds per 100 units.
      2. Riser Clamps: For supporting 5" rigid metal conduit; black steel; with 2 bolts and nuts; and 4" ears; approximately 510 pounds per 100 units.
      3. Reducing Couplings: Steel rod reducing coupling 1/2" x 5/8"; black steel; approximately 16 pounds per 100 units.
      4. C-Clamps: Black malleable iron; 1/2" rod size; approximately 70 pounds per 100 units.
      5. I-Beam Clamps: Black steel, 1-1/4" x 3/16" stock, 3/8" cross bolt; flange width 2"; approximately 52 pounds per 100 units.
      6. One-Hole Conduit Straps: For supporting 3/4" rigid metal conduit; galvanized steel; approximately 7 pounds per 100 units.
      7. Two-Hole Conduit Straps: For supporting 3/4" rigid metal conduit, galvanized steel; 3/4" strap width; and 2-1/8" between center of screw holes.
      8. Hexagon Nuts: For 1/2" rod size; galvanized steel; approximately 4 pounds per 100 units.
      9. Round Steel Rod: Black steel; 1/2" dia.; approximately 67 pounds per 100 feet.
     10. Offset Conduit Clamps: For supporting 2" rigid metal conduit; black steel; approximately 200 pounds per 100 units.

2.2 ANCHORS

   A. Provide anchors of types, sizes and materials indicated; and having the following construction features:

      1. Lead Expansion Anchors: 1/2", approximately 38 pounds per 100 units.
      2. Toggle Bolts: Springhead; 3/16" x 4"; approximately 5 pounds per 100 units.

2.3 SLEEVEs AND SEALS

   A. Provide sleeves and seals, of types, sizes and materials indicated, with the following construction features:
1. Wall and Floor Seals: Provide factory-assembled watertight wall and floor seals, of types and sizes indicated; suitable for sealing around conduit, pipe, or tubing passing through concrete floors and walls. Construct seals with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.

2.4 WALL MOUNTED DISTRIBUTING "J" HOOKS

A. Contractor shall install open ended distribution rings for wall mounted cross-connect fields above all wall mounted blocks. Two rings per vertical row.

B. Design Make:
   1. Caddy (wall mount) (mfg # CAT32)
   2. Caddy (rod mount) (mfg # CAT12BC)

2.5 LADDER RACK

A. Provide 18” ladder rack in all closet locations as shown on drawings for Communications cable support.

B. Include connecting and support hardware to suit installation. Including but not limited to:
   1. Rack to runway mount plate
   2. Wall angle support bracket
   3. Butt splice swivel
   4. Connect junction
   5. Grounding Kit. (Metallic ladder racks must be grounded)

C. Rack shall be a hollow or solid side bar nominally 3/8” thick by 1 ½” high with rungs 9” on center.

D. Shall be painted black.

E. The ladder rack shall be as manufactured by B-Line Systems, Hubbell, Cablofil, Chatsworth, or approved equivalent. Cable Tray must meet the above listed parameters and specifications.

2.6 COATINGS

A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be hot-dip galvanized.

2.7 FABRICATED SUPPORTING DEVICES

A. General: Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.
B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

PART 3 EXECUTION

3.1 GENERAL

A. Provide supporting devices which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation; and as herein specified. Where more than one type of supporting device meets indicated requirements, selection is Installer's option.

B. Install hangers, anchors, sleeves and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA and NEC for installations of supporting devices.

C. Coordinate with the building structural system and other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

D. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

E. Obtain approval from the Architect before drilling or cutting structural members.

F. Install surface-mounted cabinets and panelboards with minimum of four anchors.

3.2 MISCELLANEOUS SUPPORTS

A. Support miscellaneous network/electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.

3.3 LADDER RACK

A. Install as shown on the drawings.

B. Ladder Rack to be secured to walls and top of equipment rack. Must be grounded for all metallic ladder racks.

3.4 CABLE SUPPORTS

A. Provide 8 inch “J” hooks 2 ft. on center for all exposed wall mounted vertical cable runs.
B. Keep horizontal wall mounted cable runs to a minimum. In general, horizontal runs shall be on wall mounted ladder rack.

C. Provide category 6 cable brackets 3’ on center supported to building structure for all cable runs not supported by cable tray.

3.5 FASTENING

A. Unless otherwise indicated, fasten network/electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:
   1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine or wood screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.
   2. Holes cut into reinforced concrete beams or in concrete shall not cut reinforcing bars. If the Contractor cuts into any reinforcing bars, stop work and notify the Architect immediately. Fill holes that are not used.
   3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock-resistant fasteners for attachments to concrete slabs.

3.6 TESTS

A. Test pull-out resistance of one of each type, size, and anchorage material for the following fastener types:
   1. Expansion anchors.
   2. Toggle bolts.

B. Provide all jacks, jigs, fixtures, and calibrated indicating scales required for reliable testing. Obtain the structural Engineer's approval before transmitting loads to the structure. Test to 90 percent of rated proof load for fastener. If fastening fails test, revise all similar fastener installations and retest until satisfactory results are achieved.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. SCOPE
1. Refer to Section 27 11 16 for additional Grounding Bar requirements to be included with Communication Systems Equipment Racks.
2. This Section includes solid grounding of communications systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other sections of these Specifications.
3. All grounding and bonding shall meet the National Electrical Code (NEC) as well as local codes which specify additional grounding and/or bonding requirements. Communication bonding and grounding shall be in accordance with the NEC and NFPA.

B. Provide a telecommunications grounding and bonding system in accordance with the recommendation of TIA/EIA-607 and Article 250 of the National Electrical Code, and as described in the contract documents. Where types, sizes, ratings, and quantities indicated are in excess of NEC requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

C. Tie all grounding systems together at their origins as shown on the Drawings and as called for by the NEC.

D. Provide an insulated ground wire sized as shown, bonding, the MTS, the ITS’s and the power service grounding electrode.

1.2 QUALITY ASSURANCE

A. All methods of construction that are not specifically described or indicated in the Contract Documents shall be subject to the control and approval of the Network & Telecommunication Department. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based on the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified, and subject to approval.

1.3 SUBMITTALS

Not Used.

1.4 QUALITY ASSURANCE
A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors, terminals and fittings of types and ratings required, and ancillary grounding materials, including stranded cable, copper braid and bus, ground rods and plate electrodes, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installer: Qualified with at least 3 years of successful installation experience on projects with communications grounding work similar to that required for project.

C. Listing and Labeling: Provide products specified in this Section that are listed and labeled. The terms "listed" and "labeled" shall be defined as they are in the National Electrical Code, Article 100.
   1. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

D. Field-Testing Organization Qualifications: To qualify for acceptance, the independent testing organization must demonstrate, based on evaluation of organization-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct satisfactorily the testing indicated.

E. Electrical Component Standard: Components and installation shall comply with NFPA 70, "National Electrical Code" (NEC).

F. UL Compliance: Comply with applicable requirements of UL Standards Nos. 467 and 869 pertaining to electrical grounding and bonding.

G. IEEE Compliance: Comply with applicable requirements of IEEE Standard 142 and 241 pertaining to electrical grounding.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING MATERIALS

A. Ground conductors shall be of size indicated or required by code and type/manufacturer as listed elsewhere under Wires and Cables.

B. Manufacturers: Subject to compliance with requirements, provide products by the following:
   B-Line Systems Inc.
   Burndy Corp.
   Crouse-Hinds Co.
   Electrical Components Div; Gould Inc.
   General Electric Supply Co.
   Ideal Industries, Inc.
   Thomas and Betts Corp.
   Western Electric Co.
C. Conductor Materials: Copper with 98% conductivity.

2.2 WIRE AND CABLE CONDUCTORS

A. General: Comply with Division 260519 Section "Wires and Cables."

B. Equipment Grounding Conductor: Green insulated.

C. Grounding Electrode Conductor: Stranded cable.

D. Bare Copper Conductors: Conform to the following:

2.3 MISCELLANEOUS CONDUCTORS

A. Ground Bus: Bare annealed copper bars of rectangular cross section.

B. Braided Bonding Jumpers: Copper tape, braided No. 30 gage bare copper wire, terminated with copper ferrules.

C. Bonding Strap Conductor/Connectors: Soft copper, 0.05 inch thick and 2 inches wide, except as indicated.

D. Flexible Jumper Strap: Flexible flat conductor, 480 strands of 30-gage bare copper wire; 3/4" wide, 9-1/2" long; 48,250 cm. Protect braid with copper bolt hole ends with holes sized for 3/8" dia. bolts.

2.4 CONNECTOR PRODUCTS

A. General: Listed and labeled as grounding connectors for the materials used.

B. Pressure Connectors: High-conductivity-plated units.

C. Bolted Clamps: Heavy-duty units listed for the application.

2.5 GROUNDING ELECTRODES

A. Communications: For network systems, provide a #6 AWG minimum green insulated copper conductor in raceway from the grounding electrode system to each terminal cabinet or central equipment location.

B. Bonding Plates, Connectors, Terminals and Clamps: Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by bonding plate, connector, terminal and clamp manufacturers for indicated applications.
C. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type services indicated.

2.6 GROUNDING BARS

A. Provide telecommunication grounding bar (TGB) assembly as shown on drawings and #6 grounding wire from ground bar telecommunications grounding system.

B. Grounding wire shall be appropriately bonded to the telecommunications main grounding bar (TMGB). The TMGB shall be grounded to the main electrical service grounding electrode system.

C. NEMA approved Ground Bar Assembly to be constructed with following materials (See drawing details for additional information):
   1. Copper Ground Bar (1/4”x4”x10”) with 9/32” holes spaced 1 1/8” apart.
   2. Insulators
   3. 5/8” Lock washers
   4. Wall Mounting Brackets
   5. 5/8-11”x1” HHCS bolts

PART 3 EXECUTION

3.1 GENERAL

A. Except as otherwise indicated, provide electrical grounding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, terminals (solderless lugs), bonding jumper braid, surge arresters, and additional accessories needed for complete installation. Where more than one type unit meets indicated requirements selection is Installer's option. Where materials or components are not indicated, provide products complying with NEC, UL, IEEE, and established industry standards for applications indicated.

3.2 INSPECTION

A. Installer must examine areas and conditions under which electrical grounding connections are to be made and notify the Architect in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in an acceptable manner.

3.3 APPLICATION

A. Provide electrical grounding systems where shown, in accordance with applicable portions of NEC, with NECA's "Standard of Installation" and in accordance with recognized industry practices to ensure that products comply with requirements and serve intended functions.
B. Provide a green insulated grounding conductor sized in accordance with NEC Table 250-95 in all raceways and cables where the conductor over-current protection is 15 AMPS or larger.

3.4 INSTALLATION

A. General: Ground communications systems and equipment in accordance with NEC requirements except where the Drawings or Specifications exceed NEC requirements.

B. Coordinate with other electrical work as necessary to interface installation of electrical grounding system with other work.

C. Route grounding conductors along the shortest and straightest paths possible without obstructing access or placing conductors where they may be subjected to strain, impact, or damage, except as indicated.

3.5 CONNECTIONS

A. General: Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
   1. Use electroplated or hot-tin-coated materials to assure high conductivity and make contact points closer in order of galvanic series.
   2. Make connections with clean bare metal at points of contact.
   3. Coat and seal connections involving dissimilar metals with inert material such as red lead paint to prevent future penetration of moisture to contact surfaces.

B. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A and UL 486B.

3.6 FIELD QUALITY CONTROL

A. Upon Completion of installation of communications grounding systems, test ground resistance with ground resistance tester. Where tests show resistance to ground is over 3 ohms, take appropriate action to reduce resistance to 3 ohms, or less, by driving additional ground rods and/or by chemically treating soil encircling ground rod; then retest to demonstrate compliance.

B. Independent Testing Organization: Arrange and pay for the services of a qualified independent electrical testing organization to perform tests described below.
C. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground resistance level is specified, at service disconnect enclosure ground terminal.

D. Deficiencies: Where ground resistances exceed specified values, and if directed, modify the grounding system to reduce resistance values. Where measures are directed that exceed those indicated the provisions of the Contract, covering changes will apply.

E. Report: Prepare test reports, certified by the testing organization, of the ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. SCOPE
   1. This section includes the product and installation requirements for the fiber backbone cable.
   2. This section includes minimum requirements for the following:
      a. Inside Plant (ISP)
         1) Plenum and Riser Rated Optical Fiber Cables
         2) ARMM/CMR Copper Cables

1.3 SUBMITTALS

A. Product Data for each type of product specified.
B. Complete Product specifications including EIA/TIA compliance.
C. Test Results and Documentation as per Section 27 15 23.

PART 2 PRODUCTS

2.1 STRUCTURED CABLING SYSTEMS MANUFACTURER

A. Part numbers listed below are those of Hubbell Premise wiring equivalent by BerkTek or Commscope shall be acceptable for this project.

2.2 ARMORED INDOOR/OUTDOOR DRY LOOSE TUBE OPTICAL FIBER CABLES; PLENUM

A. MULTIMODE FIBER OPTIC CABLING (MDF to IDF Network Backbone)
   1. Shall be graded-index optical fiber waveguide with nominal 900um-core/cladding diameter.
   2. The fiber shall comply with ANSI/EIA/TIA-568B, EIA/TIA FOTPs, and ISO/IEC 11801.
   3. Transmission Characteristics for Multimode Fiber Optic Cable: Each cabled fiber shall meet the graded performance specifications below. Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-46, 53 or 61. Information transmission capacity shall be measured in accordance with ANSI/EIA/TIA-455-51 or 30.
      a. Maximum attenuation dB/Km @ 850/1300 nm: 3.5/1.5
      b. Bandwidth 3500 Mhz-km @ 850nm
      c. Bandwidth 500 Mhz-km @ 1300nm
d. Distance vs. bandwidth using a LED transmitter operating at a 1300nm wave length:

4. Physical Characteristics:
   b. Suitable for Indoor and Outdoor underground or aboveground conduits.
   c. Shall have individual fiber tube colors per TIA/EIA-598 and overall black jacket.
   d. Must be UV rated for exterior installation.

5. Network Backbone Multimode Fiber Optic Cable shall be 12-Strand, Armored Indoor/Outdoor Dry Loose Tube Cable, Plenum: Hubbell Part No. HFCD019012P4BK.

6. Note: When Fiber Optic Cable is of Armored Indoor/Outdoor construction with a Plenum jacket, Innerduct is not required as an Indoor pathway for the Fiber Optic Cabling.

PART 3 EXECUTION

3.1 FIBER OPTIC CABLE

A. Adhere to all manufacturer installation guidelines.

B. A service loop of 15 feet shall be maintained at all points of termination. Service loops shall not exceed manufacturer's recommended bend radius and shall be neatly dressed and shall not interfere with other cables and termination equipment.

C. Pulling tensions shall not exceed those recommended by the fiber optic cable manufacturer.

D. Manufacturer's minimum specified bend radius shall not be exceeded.

E. In the event that cabling is totally dielectric (nonmetallic) and installed in a nonmetallic duct, a #6 copper wire shall be placed in the conduit with the cable to be used as tracer for cable locating purposes.

F. Maintain polarization for entire system as described in ANSI/EIA/TIA-568-B.1

G. Cable shall be continuous from the MDF to the IDF.

H. The contractor shall be responsible for verifying the actual footage’s and distances identified on the drawings.

I. The contractor shall be responsible for verifying that conduits and raceways are "ready for occupancy" before cable placement.

J. The contractor shall assume the responsibility for any difficulties or damage to the cable during placement.
K. Test, label and document as per section 27 15 23.

3.2 EXAMINATION

A. Examine areas and conditions with the Installer present for compliance with requirements and other conditions affecting the performance of optical-fiber cabling system. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.3 APPLICATIONS

A. Install optical-fiber cabling for the LAN as detailed herein and on the project drawings.

3.4 INSTALLATION

A. General: Install fiber-optic cables and associated equipment and devices in accordance with industry standards and manufacturer's written instructions.

B. Install fiber-optic cable without damage to fibers, cladding, or jacket. Ensure that media manufacturer's recommended pulling tensions are not exceeded. Do not at any time bend cables to smaller radii than minimums recommended by manufacturer.

C. Install FO cables simultaneously where more than one cable is being installed in same raceway. Use pulling lubricant where necessary; compound used must not deteriorate cable materials. Do not use soap. Use a pulling means, including fish tape, rope, and basket-weave grips, that will not damage media or raceway.

D. Where Division 16 Electrical contractor does not supply cable tray or supports, provide necessary cable support to meet all applicable codes from conduit above accessible ceiling to corridor cable tray and into telecommunications rooms.

E. No splices are allowed, except at indicated splice points.

3.5 GROUNDING

A. Provide grounding connections for FO cable and other system components as required by manufacturer's written instructions.

3.6 CLEANING

A. Clean optical-fiber cabling and components of dirt and construction debris upon completion of installation.

3.7 FIELD QUALITY CONTROL
A. Prior to usage, test all equipment and components in accordance with manufacturer's published test procedures. In addition, test the cable installation with an optical time domain reflectometer (OTDR) with strip chart recording capability and anomaly resolution to within one foot in runs up to 1,000 feet in length. Test all cable segments for faulty connectors, splices, and terminations and for the integrity of the cable and its component parts. Replace malfunctioning or damaged items with new materials, then retest until satisfactory performance is achieved.

3.8 COMMISSIONING

A. Subsequent to hook ups of FO system to signal sources and destination equipment, operate systems to demonstrate proper functioning. Replace malfunctioning FO cabling system items with new materials, and then retest until satisfactory performance is achieved.

B. Documentation: Use the above time domain reflectometer to make strip chart recordings of transmission characteristics, wave form, and performance of all segments of the installation at the time of commissioning. Also, use an optical loss test set (OLTS) to measure the optical transmission loss on each optical fiber path in the system. Record loss data in a form with provision for at least 50 additional loss data entries during future maintenance operations. Bind the OTDR recordings and the record of OLTS results in a cable record book indexed for easy reference and with provision for additional data entry during future maintenance operations. Turn book over to the Owner's authorized representative upon completion of commissioning.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. SCOPE
1. This section includes the product and installation requirements for the fiber backbone cable splicing, housings, and connectors.
2. This section includes minimum requirements for the following:
   a. Inside Plant (ISP)
      1) Optical Fiber Connectors – SM/MM
      2) Optical Fiber Distribution Enclosures
      3) Optical Fiber Adapter Panels
      4) Optical Fiber Pigtails

B. SUBMITTALS
A. Product Data for each type of product specified.
B. Complete Product specifications including EIA/TIA compliance.
C. Test Results and Documentation as per Section 271523.

PART 2 PRODUCTS

2.1 STRUCTURED CABLING SYSTEMS MANUFACTURER
A. Part numbers listed below are those of Hubbell premise wiring equivalent by Commscope or Leviton are acceptable for this project.

2.2 DATA SYSTEM BACKBONE TERMINATION HARDWARE
A. All backbone fiber optic cable shall be terminated using Hubbell LC connectors and terminations are to be housed in an Hubbell manufactured rack-mount fiber optic enclosure providing proper bend radius control.
B. Fiber Optic Pigtails
1. Multimode Pigtails shall be provided with LC connectors rated for 900 um fiber, and shall be provided in equivalent fiber optic strand-count as Backbone Cable being terminated.
2. Each multimode strand of fiber shall be fusion spliced to the equivalent color strand of the multimode Pigtail, with single fiber connectors.
3. Field Installable connectors shall be fully compliant with ANSI/TIA/EIA-568-B.
4. Multimode LC Pigtails shall be Hubbell DFPCLCLCF3MM.
C. Fiber Optic Enclosures (MDF and IDF – quantity and size as required)
1. Fiber optic enclosures shall be constructed for mounting on standard 19” (48cm) equipment racks.
2. Panel shall accommodate between 12 and 24 fiber terminations using modular TFP adapter packs.
3. Fiber Optic Enclosures shall be of Fiber Connectivity type, TFP Series Fiber Panels.
4. Approved Rack Mounted for 1 RU Termination, black shall be Hubbell Part No. FEUR246CDUM
5. Provide quantity to support backbone and horizontal Fiber Optic Cabling. All strands shall be terminated.

2.3 OPTICAL-FIBER CABLING SYSTEMS

A. FO Connectors: fiber-optic cable connectors, capable of terminating FO glass cables, with diameters ranging from 125 through 1000 microns. Fabricate connectors with optical-fiber, self-centering, axial alignment mechanisms. Select resilient tip LC type connectors with quick-connect features and with insertion loss of not greater than 1.0 dB.

B. Gigabit Ethernet: fiber-optic cable shall be certified by the manufacturer to properly work with Gigabit Ethernet systems, without the use of offset connector, for distances exceeding 700 meters.

C. Fiber Optic cable and connectors shall be Manufactured, Certified and Warranted by a single manufacturer.

2.4 FIBER OPTIC CABLE ASSEMBLIES

A. All fiber interconnections will be made utilizing KRONE prefabricated fiber optic jumpers.
   1. Duplex LC to Duplex LC 2-fiber 50um Multimode Patch Cable assemblies shall be 2 meters in length.
   2. Supply Fiber Optic patch cable assemblies in quantity as specified on drawings.
   3. Cables shall be OM4 or have the modal bandwidth to match the backbone cables.

PART 3 EXECUTION

3.1 OPTICAL FIBER CONNECTORS – SM/MM

A. Adhere to all manufacturer installation guidelines.
   1. Connector shall be installed with less than .50 dB of attenuation. Connectors must be fusion-spliced, factory polished pigtails (see Network & Telecommunications management for part numbers).

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. SCOPE
   1. This section includes the product and installation requirements for the fiber backbone cable.
   2. This section includes minimum requirements for the following:
      a. Voice/Data Network Communications Cable Plant
         1) Category 6/6A TrueNet Series UTP Cables

1.2 SUBMITTALS

A. Product Data for each type of product specified.
B. Complete Product specifications including EIA/TIA compliance.
C. Test Results and Documentation as per Section 271513.

PART 2 PRODUCTS

2.1 STRUCTURED CABLING SYSTEMS MANUFACTURER

A. Part numbers listed below are those of Hubbell premise wiring equivalent by Commscope or BerkTek shall be acceptable for this project.
B. Copper cabling, connectors, patch cords, and termination equipment shall be manufactured, certified, and warranted by a single manufacturer.
C. Category 6 Channel and Components must meet or exceed TIA/EIA 568-B.2-1 Category 6 standards. Channel to consist of Category 6/6A cable, patch cords, patch panel, and jack as listed herein.

2.2 CATEGORY 6 CABLE (Horizontal Cabling to Data Network station outlets)

A. The horizontal cables must consist of Category 6 100 Ohm balanced 4-pair UTP that is approved within the Structured Cabling System warranty. The horizontal cable must exhibit matched impedance with the patch cords, jacks and patch panels at the nominal frequency bandwidth of 100 MHz. Impedance testing which is conducted with hand-held scanners that are not capable of exhibiting discrete point impedance data may use +/- 5 ohms as the reference value. Reference impedance traces from the factory using a network analyzer is recommended.
B. Cabling shall meet the published Category 6 standard per the requirements of ANSI/TIA/EIA-568-B.2. Product specifications shall be published by the manufacturer as Worst Case.

C. Cable shall be Hubbell Part No. C6RPB. All Category 6 cable shall be plenum rated where required.

D. Provide one “homerun” UTP cable between each Data outlet port indicated on the drawings and appropriate IDF. In field splicing of UTP cables shall not be permitted. Each homerun shall not exceed 90 meters in length.

E. The National Electric Code Article 800 Type CMP specification shall be recognized when UTP cables are installed, without benefit of adequate raceway, in a plenum air return.

PART 3 EXECUTION

3.1 INSTALLATION OF DATA / VOICE CABLES

A. Installation of equipment shall be made by qualified, -certified or -certifiable personnel. All installation shall be done in a neat, professional and high quality manner and in conformity with local and federal building codes and the Structured Cabling System requirements. All areas affected by installation, both inside and outside of the buildings, will be restored to their former condition. Bidder is responsible for the cost of all repairs, painting and other restoration needed due to damage caused by the installation.

B. Category 6 cables shall be installed with a minimum 18" clearance from light fixtures, electrically operated equipment and all wiring operating at 120 or more volts.

C. Data/Voice Cables shall be type, size and insulation as recommended by manufacturer and approved. Install in accordance with manufacturer's written instructions and in compliance with NEC.

D. Coordinate installation with other Work.

E. Install without damaging conductors or jacket.

F. Do not either in handling or installation bend cable to smaller radii than minimum recommended by manufacturer.

G. Ensure that minimum manufacturer's recommended pulling tensions are not exceeded.
H. Pull conductors simultaneously where more than one is being installed in same raceway. Use pulling means, including fish tape, cable, rope, and basket weave wire/cable grips that will not damage media or raceway.

I. Use pulling compound or lubricant where necessary; compound used must be approved by the cable manufacturer.

J. Install exposed cable, parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.

K. No splices are allowed except at indicated splice points.

L. Tighten connectors and terminals, including screws and bolts, in accordance with manufacturer's published instructions or torque tightening values.

M. At no time during or after installation shall the successful bidder use plastic zip-lock tie wraps for securing the cables, both in the plenum and in the closets. The accepted method of securing the cables is the utilization of reusable hook and loop cable ties.

3.2 FIELD QUALITY CONTROL: HORIZONTAL CABLING

A. Prior to usage, test wiring for electrical continuity and for short circuits.

B. Test all cable segments for faulty connectors, splices, terminations, and the integrity of the cable and its component parts.

C. "Category 6" System Certification
   1. Coordinate this testing with the Architect and Engineer. Notify both the Architect and Engineer at least seven days in advance of testing in order for the Architect and Engineer to make plans to witness this testing.
   2. After all punchdowns and cable terminations are complete test each Category 6 cable from the wiring closet to the Computer Outlet to Channel Testing requirements including the Category 6 Patch Cable assemblies.
   3. This testing shall be conducted with a "Scope 350" EIA/TIA Category 6 LAN Tester or approved equal.
   4. Measure and record the following data:
      a. Line Map: Connectivity and cable destination; show shorts, opens, combined shorts/opens, swaps, and room identification.
      b. Resistance
      c. Length
      d. Mutual Capacitance
      e. Attenuation: Swept Frequency 200kHz to 100MHz (sampled at 100kHz increments)
      f. Near-end Crosstalk (NEXT): Swept Frequency 200kHz to 100MHz (sampled at 100kHz increments)
      g. Impulse Noise
h. Average Noise
i. Traffic Noise
j. Propagation Rate

5. All cables and product connectivity shall conform to the minimum requirements of ANSI/TIA/EIA-568-B.2, Category 6 standard and product specification data shall be published by the manufacturer based on Worst Case testing results.

6. Document the test results in graphic plot format immediately following each test, via a Wavetek "PTR-1" printer. Provide two copies of the recordings bound in two separate cable record books, indexed for easy reference and transmit these books to the Architect for review by the Engineer. Bind the original recordings in a cable record book indexed for easy reference during future maintenance operations and turn book over to the Owner's authorized representative. Each cable shall be printed on a separate sheet of 8 ½” x 11” paper, one page per cable.

D Replace malfunctioning transmission media with new materials, then retest until satisfactory performance is achieved.

3.3 COMMISSIONING

A. Subsequent to hookups of data transmission cable and equipment demonstrate proper functioning. Replace malfunctioning components with new materials, and then retest until satisfactory performance is achieved.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. SCOPE
   1. This section includes the minimum requirements for the testing, certification
      administration and identification of backbone and horizontal cabling.
   2. This section includes minimum requirements for the following:
      a. UTP testing and testers
      b. Labels and Labeling
      c. Documentation

1.2 SUBMITTALS

A. Manufacturers catalog sheets and specifications for fiber and copper cable testers.

   B. Test reports

PART 2 PRODUCTS

2.1 100 OHM UTP TESTER

A. Shall be capable of testing to TIA 568-B.1 criteria.

B. Physical interface shall be modular RJ-45 connector and a serial port with DB-9
   connector.

C. Shall have auto-testing to determine if cable meets the requirements of TIA/EIA
   568-B.1, ISO Class C, D, 10 Base-T, Token Ring, Fast Ethernet and ATM
   standards.

D. Acceptable Manufacturers:
   1. Fluke or better

2.2 LABELS

A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL
   969.

B. Shall be preprinted or laser printed type.

C. Where used for cable marking provide vinyl substrate with a white printing area and
   a clear “tail” that self laminates the printed area when wrapped around the cable. If
   cable jacket is white, provide cable label with printing area that is any other color
than white, preferably orange or yellow – so that the labels are easily distinguishable.

D. Where insert type labels are used provide clear plastic cover over label.

E. Provide plastic warning tape 6 inches wide continuously printed and bright colored 18” above all direct buried services, underground conduits and duct-banks.

F. Acceptable Manufacturers:
   1. Brothers (or better)

PART 3 EXECUTION

3.1 100 OHM UTP CABLE TESTING

A. The testing parameters called for in this section shall include the horizontal Link/channel for all installed drop locations.

B. Test cable with test set to match the NVP for the cable as stated by the cable manufacturer of the cable being installed.

C. The test parameters shall include Wire Map, Length, Attenuation, PS-NEXT, PS-ACR, PS-ELFEXT and Return-Loss

D. Wire Map
   1. The wire map test shall verify pair to pin termination at each end and check for connectivity errors. The wire map shall indicate the following for each of the eight conductors:
      a. Continuity to the remote end
      b. Shorts between any two or more conductors
      c. Crossed pairs
      d. Reversed Pairs
      e. Split Pairs
      f. Any other miss wiring

E. Cable Performance
   1. Must meet the minimum acceptable values as indicated in TIA/EIA 568B.1 Category 6 (TIA/EIA 568B.2-1) requirements.

3.2 IDENTIFICATION & LABELING

A. Confirm specific labeling requirements with customer’s project coordinator prior cable installation or termination.

B. Cables
   1. Backbone cables shall be marked at each endpoint and at all intermediate pull/access points or junction boxes. Label shall indicate origination and
destination TR ID, sheath ID and strand or pair range.

2. Horizontal cables shall be marked at each end, on the sheath indicating the TR, patch panel and panel port to which the cable is wired. Faceplates and Patch Panels

C. Faceplates and Patch Panels
   1. Faceplates
      a. Shall be labeled to indicate the room number and panel port [A thru Z] to which the cable is wired for each cable that it houses.

3.3 RECORD COPY AND AS - BUILT DRAWINGS

A. Provide record copy drawings periodically throughout the project as per 25030 or as requested by the project manager and at end of the project. Record copy drawings shall include notations reflecting the as built conditions of any additions to or variation from the drawings provided.

3.4 TEST RESULTS

A. Horizontal Copper Cabling
   1. The Contractor shall test all cables and submit all horizontal copper cable test result data in electronic format, with the resulting file formatted with one test result per 8.5”x 11” page.
   2. To provide the test results in an acceptable format:
      a. Export or Download the test results from the cable tester to a *.txt format.
      b. Then open the *.txt file in Microsoft WORD 6.0 and save the file as a *.doc file.

B. High Pair Count Copper Cables
   1. The Contractor shall test all high count copper cables and submit test result information in an electronic format. Minimal acceptable formats are Word 6.0 or Excel 95/97.
   2. See project coordinator for required format for test report documentation.

END OF SECTION
PART 1  GENERAL

1.1  SCOPE

A.  Summary
   1.  Provide all labor, materials, tools, and equipment required for the complete installation of work called for in the Contract Documents

1.2  SUBMITTALS

A.  Submit manufacturer warranty information with bid.

B.  Contractor certification to provide warranty with bid.

1.3  RELATED DOCUMENTS

A.  Contractor shall submit a material list with the bid submittal. This shall include quantity, description and manufacturer’s part numbers for all components in proposed system.

B.  Contractor shall submit a qualification summary for each individual who will perform services involved with this project. Qualification summary shall list proposed job responsibility (i.e. Project Management, Designer, Installer, etc.), and any relevant experience or qualifications.

C.  Contractor shall submit a list of all test equipment proposed for the completion of this project. Test equipment list shall include test device manufacturer, model number, firmware revision, client software revision if applicable, and any other information that may be pertinent to this project.

D.  Contractor shall provide a list of product technical training for all systems proposed, and shall provide manufacturer’s letters or certificates of completion for said training.

E.  Contractor shall provide a list including the company name, contact name, and phone number of all subcontractors that will be used to complete this project. Subcontractor shall have the same training and certifications as contractor and shall be pre-approved (prior to bid opening) by the Owner.

1.4  NETWORK SUPPORT
A. Contractor shall provide for a period of 1 year upon completion and final acceptance of system a customer service representative available to the district on an unlimited basis. The customer representative will be capable of supplying additional training on all systems provided under this contract. The cost of this representative shall be included in the base bid amount of this contract.

1.5 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1 Section

1.6 PROJECT CLOSEOUT

A. When all work has been completed and before final acceptance, the Contractor shall furnish to the Architect a complete set of reproducible contract drawings clearly showing all contract work "as-built". Prior to delivery each drawing shall be signed and dated by the Contractor's project manager attesting to the accuracy of the as-built drawing.

B. Mark up a clean set of Specifications to indicate approved substitutions, change orders and actual equipment and materials used.

PART 2 MAINTENANCE

2.1 CABLE PLANT MAINTENANCE

A. General: Sequence, coordinate, and integrate the various elements of network systems, materials, and equipment. Comply with the following requirements:

1. Coordinate network systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for network installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of network materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.
9. Coordinate the cutting and patching of building components to accommodate installation of network equipment and materials.
10. Coordinate the installation of network materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components.
11. Install network equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations.

2.2 CLEANING
A. Refer to the Division 1 Section PROJECT CLOSEOUT or FINAL CLEANING for general requirements for final cleaning.

2.3 TESTING
A. Contractor, at his own expense, shall make any tests directed by an inspection authority or by the Architect and shall provide all equipment, instruments and materials to make such tests.
B. Unless otherwise approved, all connections shall be made and all components shall be in place, complete and operational, at time of final inspection and tests.
C. Time of such tests, the manner in which they are made and the results of the tests, shall be subject to approval.
D. Upon completion of work, all component parts, both singularly and as a whole, shall be set, calibrated, adjusted and left in satisfactory operating condition to suit load conditions, by means of instruments furnished by the Contractor.
E. Complete testing of equipment and systems shall be provided throughout this project.
F. Industry standards shall apply except as otherwise specified.
G. Provide all labor, premium labor and materials required by shop and field testing as specified in the Contract Documents and as required by the authorities having jurisdiction.
H. Notify the Architect seven (7) days prior to the testing dates. Upon completion of a test, a statement of certification shall be forwarded to the Architect for his approval.
I. Conduct tests at a time agreeable to the Architect. Provide premium labor as necessary.
J. Products that are found defective or do not pass such tests shall be removed and replaced at the Contractor's expense. Tests shall be repeated.

2.4 INSTRUCTIONS TO THE OWNER

A. After the tests and adjustments have been made, approved factory authorized system representatives and the Contractor shall fully instruct Owner in all details of operation and maintenance of equipment installed under this Contract. Dates and times of such instructions shall be as directed.

2.5 CABLE PLANT REPLACEMENT/WARRANTIES

A. Refer to the Division 1 Section SPECIFIC WARRANTIES for procedures and submittal requirements for warranties and to individual equipment specifications for additional warranty requirements. If a contradiction exists, the most demanding requirements shall prevail.

B. Compile and assemble the warranties specified in Division 27 into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include date of beginning of warranty or bond; duration of warranty or bond; and names, address, and telephone numbers and procedures for filing a claim and obtaining warranty services.

PART 3 EXECUTION

3.1 STRUCTURED CABLELING SYSTEM WARRANTY

A. The successful Bidder shall warrant that all materials and equipment are new, in good working order, free from defects and in conformance with the Structured Cabling System specifications. All installed equipment must conform to the manufacturer's official published specifications. The warranty shall begin at the Structured Cabling System acceptance date and remain in effect for a period of twenty years from that date. The successful Bidder shall agree to repair, adjust and/or replace (as determined by the Purchaser to be in its best interest) any defective equipment, materials or other parts of the Structured Cabling System at the successful Bidder's sole cost. The Purchaser will incur no costs for service or replacement of parts within the channel during the warranty period of 20 years.
B. Selected vendor must provide a Network Performance Solutions Warranty for a minimum of 25 years. The Network Performance Solutions Warranty must guarantee the electrical performance to meet ANSI/TIA-568 for a period of twenty-five (25) years beginning at the acceptance by the Purchaser. The warranty must include complete parts and labor replacement of defective products. The products must be warranted for a minimum of 25 years by the manufacturer. The Structured Cabling System warranty must have provisions for replacing the contracting organization at no cost to the customer should the contractor lose his status as an authorized installer or otherwise not fulfill his obligations to the customer as outlined in the System warranty program.

C. The successful Bidder shall warrant and supply evidence that the installation of materials and hardware will be made in strict compliance with all applicable provisions of the National Electric Code, the rules and regulations of the Federal Communications Commission, and state and/or local codes or ordinances that may apply.

D. The successful Bidder shall warrant that the TE Connectivity Structured Cabling System will function as specified in the approved manufacturer's Technical Description Guide.

E. The successful Bidder shall warrant that the TE Connectivity Structured Cabling System will accommodate traffic at the levels specified in all appropriate sections of this Request for Proposal.

3.2 CATEGORY 6/6A CHANNEL SPECIFICATIONS

A. Structured Category 6/6A Cabling System must meet or exceed ISO/IEC 11801, including Amendments, and/or ANSI/TIA-568 for a period of twenty-five (25) years. Channel to consist of Category 6 cable, patch cords, patch panel, and jack as listed herein.

B. Structured Cabling System Specifications (Patch Panel to Jack)
1. Minimum values [min] represent worst case allowable in system. Minimum values are derived from and meet or exceed ANSI/TIA-568-C.2 Category 6/6A values.
2. Typical values [typical] were obtained from passive testing over a 100 meter channel in a UL certified laboratory under controlled conditions.
3. C6T channel and components guaranteed to meet or exceed ANSI/TIA-568-C.2 Category 6/6A standards. Channel consisted of cable, Patch Cord, Patch Panel and jack.

3.3 GENERAL

A. Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.
B. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.

C. Install identification devices as indicated, in accordance with manufacturer's written instructions and requirements of NEC.

D. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.

E. Regulations: Comply with governing regulations and requests of governing authorities for the identification of electrical work.

3.4 CABLE/CONDUCTOR IDENTIFICATION

A. Apply cable/conductor identification on each cable/conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present. Match identification with marking system used on shop drawings, contract documents, and similar previously established identification for project's electrical work.

3.5 OPERATION SIGNS

A. Provide instruction signs with approved legend where instructions or explanations are needed for system or equipment operation.

3.6 INSTALLATION

A. Provide equipment identification labels of engraved plastic-laminate on each major unit of electrical equipment in building, including central or master unit of each electrical system. This includes computer systems, unless unit is specified with its own self-explanatory identification. Except as otherwise indicated, provide single line of text, with 1/2-inch-high lettering on 1-1/2-inch-high label (2-inch-high where two lines are required), white lettering in black field. Text shall match terminology and numbering of the Contract Documents and shop drawings. Apply labels for each computer system component.

B. Provide labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

END OF SECTION
PART 1 – GENERAL

1.1 SUMMARY

A. SCOPE
   1. This section includes the minimum requirements for the testing, certification administration and identification of backbone and horizontal cabling.
   2. This section includes minimum requirements for the following:
      a. Fiber optic testing and testers
      b. Labels and Labeling
      c. Documentation

1.2 QUALITY ASSURANCE

A. All testing procedures and testers shall comply with applicable requirements of:
   1. ANSI/TIA/EIA 568- B.1 Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements

B. Identification and administration work specified herein shall comply with the applicable requirements of:
   1. ANSI/TIA/EIA – 606-A Administration Standards.
   2. ANSI/TIA/EIA – 569-A Pathway and Spaces
   5. BICSI Telecommunications Cabling Installation Manual
   6. BICSI Telecommunications Distribution Methods Manual

1.3 SUBMITTALS

A. Manufacturers catalog sheets and specifications for fiber and copper cable testers.

B. Test reports

PART 2 PRODUCTS

2.1 OPTICAL FIBER CABLE TESTERS

A. Multimode optical fiber light source
1. Shall be capable of testing to TIA 568-B.1 and ANSI/TIA/EIA 526-14A criteria.
2. Shall meet the launch requirements of ANSI/EIA/TIA-455-50B.
3. Provide 850nm and 1300nm +/- 20 nm wavelength LED light sources
4. Spectral width of sources shall be <\= 50nm for 850nm wavelengths and <\= 140nm for 1300nm wavelengths.
5. The output of the light source shall be 8 MW for 62.5um core optical fiber
6. Output Stability +/- 0.40 dB from 0 to 50 degrees C
7. Long Term output stability +/- 0.10dB at 25 degrees C
8. Power shall be from rechargeable Ni-Cad batteries
9. Connector types shall include: MTRJ, ST and SC
10. Acceptable Manufacturers: Fluke; mfg# DPS2000 + Fiber Test Kit (or better)

B. Single mode optical fiber light source
1. Shall be capable of testing to TIA 568-B.1 criteria.
2. Shall meet the requirements of ANSI/TIA/EIA 526-7.
3. Provide 1300nm and 1500nm +/- 20 nm wavelength Laser light sources
4. Output Stability +/- 0.40 dB from 0 to 50 degrees C
5. Long Term output stability +/- 0.10dB at 25 degrees C
6. Power shall be from rechargeable Ni-Cad batteries
7. Connector types shall include: MTRJ, ST and SC
8. Design make:
9. Acceptable Manufacturers:
10. Fluke – DPS2000 (or better)

C. Power Meter
1. Shall be capable of testing to TIA 568-B.1 criteria.
2. Provide 850nm, 1300nm and 1500nm +/- 20 nm wavelength test capability
3. Measurement range shall be from 10 to -60 dBm
4. Accuracy shall be +/- 5% at 0 to -50dBm and +/- 10% 10 to 0dBm and -50 to -60 dBm.
5. Resolution shall be 0.1 dB
6. Connector types shall include: ST and SC
7. Design make:
8. Acceptable Manufacturers:
   a. Fluke - Model 43 B (or better)

D. Optical Time Domain Reflectometer (OTDR)
1. Shall be capable of testing to TIA 568-B.1 criteria.
2. Shall have a front CRT display
3. Connector types shall include: ST and SC
4. Design Make: Fluke or better

2.2 LABELS

A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.
B. Shall be preprinted or laser printed type.

C. Where used for cable marking provide vinyl substrate with a white printing area and a clear “tail” that self laminates the printed area when wrapped around the cable. If cable jacket is white, provide cable label with printing area that is any other color than white, preferably orange or yellow – so that the labels are easily distinguishable.

D. Where insert type labels are used provide clear plastic cover over label.

E. Provide plastic warning tape 6 inches wide continuously printed and bright colored 18” above all direct buried services, underground conduits and duct-banks.

F. Acceptable Manufacturers:
   1. Brothers (or better)

PART 3 - EXECUTION

3.1 OPTICAL FIBER CABLE TESTING

A. Test all fibers with launch and far end cable of sufficient length for the OTDR to be able to see through all installed connectors.

B. Localized attenuation shall not exceed 0.50 dB at any point.

C. Backbone multimode fiber shall be tested at both 850nm and 1300 nm in accordance with ANSI/EIA/TIA-526-14A method B.

D. Backbone single mode fiber shall be tested in at both 1310nm and 1550 nm in accordance with ANSI/EIA/TIA-526-14A method A.1.

E. Multimode fiber shall conform to the following:

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<thead>
<tr>
<th>Length (meters)</th>
<th>Attenuation (dB)</th>
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</thead>
<tbody>
<tr>
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<table>
<thead>
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<th>Attenuation (dB)</th>
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</thead>
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<td>1500</td>
<td>3.8</td>
</tr>
<tr>
<td>2000</td>
<td>4.5</td>
</tr>
</tbody>
</table>

3.2 IDENTIFICATION & LABELING
A. Confirm specific labeling requirements with customer’s project coordinator prior to cable installation or termination.

B. Cables
   1. Backbone cables shall be marked at each endpoint and at all intermediate pull/access points or junction boxes. Label shall indicate origination and destination TR ID, sheath ID and strand or pair range.
   2. Horizontal cables shall be marked at each end, on the sheath indicating the TR, patch panel and panel port to which the cable is wired. Faceplates and Patch Panels

C. Faceplates and Patch Panels
   1. Optical Fiber Patch Panels
      a. Fiber patch panels shall be marked using adhesive labels indicating the range of circuits installed to it.
      b. Each port shall be labeled with the origination and destination with the individual strand ID.

3.3 RECORD COPY AND AS - BUILT DRAWINGS

A. Provide record copy drawings periodically throughout the project as per 25030 or as requested by the project manager and at end of the project. Record copy drawings shall include notations reflecting the as built conditions of any additions to or variation from the drawings provided.

3.4 TEST RESULTS

A. Fiber Optic Cables
   a. The Contractor shall test all fiber optic cables and submit all fiber test result data in an electronic format and provide one (1) hard copy of the test results showing graphically, the entire length of the fiber.
      1) Reports shall show circuit ID, cursor marks, total attenuation, date of installation and test used.
   b. Contractor shall submit (1) copy of software capable of viewing the electronic test result files.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. SCOPE
1. This section includes the product and installation requirements for the communications faceplates and connectors.
2. This section includes minimum requirements for the following:
   a. Communications Faceplates
   b. Category 6 Connectors

1.2 SUBMITTALS

A. Product Data for each type of product specified.
B. Complete Product specifications including EIA/TIA compliance.
C. Test Results and Documentation as per Section 27 15 13.

PART 2 PRODUCTS

2.1 STRUCTURED CABLING SYSTEMS MANUFACTURER

A. Part numbers listed below are those of Hubbell Premise wiring, equivalent by Leviton or Commscope shall be acceptable for this project.
B. Copper cabling, connectors, patch cords, and termination equipment shall be manufactured, certified, and warranted by a single manufacturer.
C. Category 6 Channel and Components must meet or exceed TIA/EIA 568-B.2-1 Category 6 standards. Channel to consist of Category 6 cable, patch cords, patch panel, and jack as listed herein.

2.2 CATEGORY 6 DATA AND VOICE CONNECTORS (QUANTITY AND TYPE AS DESCRIBED ON DRAWINGS)

A. All jacks must meet the Category 6 standard per TIA/EIA-568-B.2-1. Jacks must be provided as individual units in order to provide the maximum flexibility. Jacks must support a minimum of 200 reterminations.
B. Data and Voice Outlets shall be rated to support Gigabit Ethernet applications
C. Data and Voice Outlets shall be configured to EIA-568B wiring standards
D. Category 6 Data Primary Connectors shall be Hubbell Part No. HXJ6B (Modular jack, orange).

2.3 DATA FACEPLATES AND INSERTS (QUANTITY AND TYPE AS DESCRIBED ON DRAWINGS)

A. Wall outlet termination will utilize modular wallplates.

B. Workstation Data Outlets – Surface Mounted
   1. Flush mount Faceplates shall fit standard single-gang boxes, and shall be provided with two outlet labeling areas, and individual port ID area. Each workstation faceplate shall include two blank paper labels, two clear plastic label protectors, and six reversible-icon ID tabs numbered 1 through 6 (icon colors to match faceplate), and two mounting screws (#6-32 x 15/16”). Verify outlet color with owner/Architect prior to installation. Provide faceplate size as necessary to accommodate workstation data/voice outlet configuration.
      a. Single gang 2-port flush mount faceplate with 2 ports, shall be Hubbell Part No. SSFL12 (stainless steel)
   2. Provide the proper combination of connectors and blank filler inserts to construct a face plate with the proper number of outlets as required by the drawings. The colors of each piece will match one another.

C. Provide the proper combination of filler inserts and adapter inserts to construct a faceplate with the proper number of outlets as required by the drawings. The colors of each piece shall match one another – Verify color with owner/Architect.

PART 3 EXECUTION

3.1 INSTALLATION OF DATA / VOICE CABLES

A. Installation of equipment shall be made by qualified, certified or certifiable personnel. All installation shall be done in a neat, professional and high quality manner and in conformity with local and federal building codes and the Structured Cabling System requirements. All areas affected by installation, both inside and outside of the buildings, will be restored to their former condition. Bidder is responsible for the cost of all repairs, painting and other restoration needed due to damage caused by the installation.

B. Category 6 cables shall be installed with a minimum 18" clearance from light fixtures, electrically operated equipment and all wiring operating at 120 or more volts.

C. Data/Voice Cables shall be type, size and insulation as recommended by manufacturer and approved. Install in accordance with manufacturer's written instructions and in compliance with NEC.

D. Coordinate installation with other Work.
E. Install without damaging conductors or jacket.

F. Do not either in handling or installation bend cable to smaller radii than minimum recommended by manufacturer.

G. Ensure that minimum manufacturer's recommended pulling tensions are not exceeded.

H. Pull conductors simultaneously where more than one is being installed in same raceway. Use pulling means, including fish tape, cable, rope, and basket weave wire/cable grips that will not damage media or raceway.

I. Use pulling compound or lubricant where necessary; compound used must be approved by the cable manufacturer.

J. Install exposed cable, parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.

K. No splices are allowed except at indicated splice points.

L. Tighten connectors and terminals, including screws and bolts, in accordance with manufacturer's published instructions or torque tightening values.

M. At no time during or after installation shall the successful bidder use plastic zip-lock tie wraps for securing the cables, both in the plenum and in the closets. The accepted method of securing the cables is the utilization of KRONE reusable hook and loop cable ties.

3.2 TERMINATIONS

A. Terminations at the RJ-45 data jacks shall be made in accordance with EIA/TIA Standard T568B.

3.3 COLOR CODING

A. All data wiring shall be color coded as per ANSI/TIA/EIA-568-A. This color coding shall be consistent and continuous throughout the system.

3.4 FIELD QUALITY CONTROL: HORIZONTAL CABLING

A. Prior to usage, test wiring for electrical continuity and for short circuits.

B. Test all cable segments for faulty connectors, splices, terminations, and the integrity of the cable and its component parts.

C. "Category 6" System Certification
1. Coordinate this testing with the Architect and Engineer. Notify both the Architect and Engineer at least seven days in advance of testing in order for the Architect and Engineer to make plans to witness this testing.

2. After all punchdowns and cable terminations are complete test each Category 6 cable from the wiring closet to the Computer Outlet to Channel Testing requirements including the Category 6 Patch Cable assemblies.

3. This testing shall be conducted with a "Scope 350" EIA/TIA Category 6 LAN Tester or approved equal.

4. Measure and record the following data:
   a. Line Map: Connectivity and cable destination; show shorts, opens, combined shorts/opens, swaps, and room identification.
   b. Resistance
   c. Length
   d. Mutual Capacitance
   e. Attenuation: Swept Frequency 200kHz to 100MHz (sampled at 100kHz increments)
   f. Near-end Crosstalk (NEXT): Swept Frequency 200kHz to 100MHz (sampled at 100kHz increments)
   g. Impulse Noise
   h. Average Noise
   i. Traffic Noise
   j. Propagation Rate

5. All cables and product connectivity shall conform to the minimum requirements of ANSI/TIA/EIA-568-B, Category 6 standard and product specification data shall be published by the manufacturer based on Worst Case testing results.

6. Document the test results in graphic plot format immediately following each test, via a Wavetek "PTR-1" printer. Provide two copies of the recordings bound in two separate cable record books, indexed for easy reference and transmit these books to the Architect for review by the Engineer. Bind the original recordings in a cable record book indexed for easy reference during future maintenance operations and turn book over to the Owner's authorized representative. Each cable shall be printed on a separate sheet of 8 ½” x 11” paper, one page per cable.

D Replace malfunctioning transmission media with new materials, then retest until satisfactory performance is achieved.

3.6 COMMISSIONING

A. Subsequent to hookups of data transmission cable and equipment demonstrate proper functioning. Replace malfunctioning components with new materials, and then retest until satisfactory performance is achieved.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. SCOPE
   1. This section includes the product and installation requirements for the communications custom cable assemblies.
   2. This section includes minimum requirements for the following:
      a. Communications Category 6 Patch Cords
      b. Communications Optical Fiber Patch Cords

1.2 SUBMITTALS

A. Product Data for each type of product specified.

B. Complete Product specifications including EIA/TIA compliance.

C. Test Results and Documentation as per Section 27 15 13.

PART 2 PRODUCTS

2.1 STRUCTURED CABLELING SYSTEMS MANUFACTURER

A. Part numbers listed below are those of Hubbell Premise wiring, equivalent by CommScope or Berk-Tek shall be acceptable for the project.

B. Copper cabling, connectors, patch cords, and termination equipment shall be manufactured, certified, and warranted by a single manufacturer.

C. Category 6 Channel and Components must meet or exceed TIA/EIA 568-B.2-1 Category 6 standards. Channel to consist of Category 6 cable, patch cords, patch panel, and jack as listed herein.

2.2 OPTICAL FIBER PATCH CORDS

A. Shall be a duplex fiber cable meeting the transmission characteristics of the optical fiber horizontal cable.

B. Cables shall be aquamarine in color for multi-mode connections.

C. The following configurations may be required:
   1. LC/LC
2.3 CATEGORY 6 PATCH CABLE ASSEMBLIES

A. Patch cords shall be a major part of the Structured Cabling System and the bidder should show them on a bill of materials. This Contractor shall provide copper patch cables for every active cable. Active copper cables shall coincide with the number of outlets on the project. Two (2) copper patch cables shall be provided for every active cable, one (1) for equipment room side and one (1) for workstation side, respectively. All patch cords shall be Structured Cabling System factory made and shall not be field terminated. Each patch cord shall be of the appropriate length for the field of use and of lengths that are acceptable within the Structured Cabling System. Each patch cord shall have the appropriate ends for the intended field. Patch cords may not be cut in half for single-end punch down; products specifically manufactured for that purpose must be used.

B. Category 6 patch cords shall meet Category 6 component specification and be impedance matched for use in the Manufacturer end-to-end channel Structured Cabling System.

C. DESIGN REQUIREMENTS
   1. Category 6 patch cords shall be constructed with a smoke-colored polycarbonate plug having vertically staggered, trifurcated contacts, each having 50 micro-inches of gold plating.
   2. Plug dimensions and function shall comply with FCC 47, part 68.5.
   3. Patch cords shall have a snag-less feature, integral to the strain relief boot on each end. Strain relief boot shall be molded PVC, and color matched to the cable jacket.
   4. Patch cords shall be constructed with category 6 patch cable, with 24 AWG 7/32 tinned copper stranded conductors, each insulated with polyethylene, and overall jacket with UL flame-retardant PVC.
   5. Patch cords shall be manufactured using a T568B wiring format and shall function suitably for either T568A or T568B wiring schemes.
   6. Patch cords shall be available in the following colors: black, blue, gray, yellow, orange, red, green, white, and purple. Custom lengths and colors shall be available with a delivery lead-time quotation.
   7. Standard patch cord lengths shall range from 3 ft. to 20 ft.
   8. Category 6 patch cords shall be backward compatible with existing Category 3, 5, and 5e cabling systems for fit, form, and function.
   9. PATCH CORDS SHALL BE MANUFACTURED IN THE USA.

D. PERFORMANCE REQUIREMENTS
   1. All transmission performance parameters shall be independently verified by a UL or ETL third party testing organization.
   2. Category 6 patch cords shall meet or exceed Category 6 component transmission requirements for connecting hardware, as specified in ANSI/TIA/EIA-568-B.2-1 standard.
   3. The manufacturer shall provide Category 6 component compliance certificates from third party testing organization upon request.
4. Patch cords shall be cUL and UL LISTED 1863.
5. Patch cords shall exceed IEEE 802.3af DTE Power specification to 4 times the rated current limits with no degradation of performance or materials.
6. Patch cords shall be third party verified, error-free GIGABIT ETHERNET performance to IEEE 802.3ab.
7. Category 6 patch cords shall meet or exceed the 4-connector channel transmission performance requirements of Category 6, per ANSI/TIA/EIA-568-B.2-1 standard.
8. The 4-connector channel test configuration shall utilize Category 6 patch panels, blocks, and jacks, with Category 6 patch cords, all from the same manufacturer, with qualified Category 6 cable.

E. Acceptable Manufacturers:
1. Workstation side Data and Voice Category 6 Patch cables shall be Hubbell Part No. NSC6B15 (15 ft. blue).
2. Equipment side Data Category 6 patch cables shall be Hubbell Part No. NSC6B10 (10 ft. blue).

PART 3 EXECUTION

3.1 PREPARATION
A. Horizontal and backbone cabling of the proper category shall be fully deployed throughout the building according to applicable codes and standards.
B. Telecommunications outlet locations, patch panels in each tr, and patch panels in the er shall be installed and terminated complete per manufacturer’s instructions, and applicable codes and standards.
C. Faceplates at each to shall be assembled complete and properly mounted.
D. Metallic horizontal cable pathways shall be bonded to an approved ground according to ANSI-J-STD-607.

3.2 INSTALLATION
A. Remove patch cords from bags and apply channel or port identification labels per specification. Patch cord lengths should match the distance between connection points, with enough slack for cable management and bend radius control.
B. For cross-connect panels in the closet, place the patch cords properly into the installed front cable organizer. Plug each end into the respective panel and equipment ports. Push the plug into the receptacle until the latch clicks into position. Installed patch cords should be neat, with no kinks, tangles, or tight bends.
C. To connect workstation equipment to the TO, route the patch cord behind furniture and plug into the network port. Patch cords should not interfere with the operator space or electrical cords. (Note: workstation cords are normally installed after placement of office furniture).

3.3 FIELD QUALITY CONTROL – TESTING

A. Note: if permanent link tests are complete, and channel testing is not required in the contract documents, then channel testing after patch cord installation is not required. Proceed with step ‘b’ below only if channel testing is required in the contract documents.

B. For channel testing, each channel in the horizontal and backbone cabling system shall be identified and tested individually, using an industry standard level iii tester with correct settings.

C. Each channel, including patch cord on each end, shall be tested for the parameters listed below.

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<thead>
<tr>
<th>Wire Map / Continuity</th>
<th>Length</th>
<th>Insertion Loss</th>
</tr>
</thead>
<tbody>
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<tr>
<td>PSELFEXT</td>
<td>Delay and Delay Skew</td>
<td>Return Loss</td>
</tr>
</tbody>
</table>

D. A “PASS” indication shall be obtained for each channel using a level III tester.

E. Completed test reports shall be submitted per contract requirements of division 01 section 01 33 19: field test reporting.

F. See “Warranty” in PART 1 for provisions of the Hubbell channel full coverage warranty.

3.4 CROSS CONNECT

A. Cross connects shall be made with 1 pair and 2 pair wire as required by circuit being connected. Coordinate cross connect colors.

END OF SECTION
PART 1 GENERAL

1.1 PROJECT TEAM

A. Owner:
Washington County Public Schools
Boonsboro High School
10 Campus Ave
Boonsboro, Maryland 21713

1.2 PROJECT SUMMARY

A. Audio-visual integration bids are requested for qualified AV systems contractors to
furnish and install AV communication and control systems the renovation project
for the Main Auditorium at Boonsboro High School, Boonsboro, Maryland.

B. The AV scope of work covers eight (8) main areas in the building:
1. Auditorium
2. Technical Booth
3. Lobby
4. Stage
5. Band Room
6. Storage Areas
7. Drama Room
8. Other Classroom Areas as necessary

C. All submitted bids must include: All required labor, materials, tools, lift equipment,
transportation services, engineering, project management and administration
necessary to provide and install complete and fully functional audio-visual and
theatrical lighting systems, as described in this specification drawings. The system
design includes, but is not limited to the following:
1. Audio System Equipment: Loudspeakers (point source, monitors, drop
celing, and outdoor), speaker rigging, wireless microphones, mixers,
amplifiers, signal processing equipment (DSP), and audio source equipment.
2. Video System Equipment: Image displays (projectors, flat panel monitors,
etc.), high definition signal transport devices, signal routing and processing
equipment, and other video signal source equipment.
3. Projection screen, low voltage interface.
4. Equipment rack, fans, rack accessories as appropriate, system power control
and sequencing, rack mounting hardware and devices.
5. System cabling (plenum and non-plenum), connectors, plates, cabling routing
and raceways.
6. AV device mounts, device specific mounting brackets, rigging and
substructure materials such as all-thread, Unistrut, aircraft cable and hardware.
7. Control System, control processor(s), touchpanels, network distribution, power distribution, wireless access, and third-party control.

D. The items listed above (Section C) are to be furnished and installed by the AV Systems Contractor as part of this specification. The following items shall be provided by the Owner or General Contractor as required. It is the AV Systems Contractor’s responsibility to coordinate the proper purchase and installation of these items as it relates to the AV systems scope of work.

1. AC power, circuits, outlets, etc. (AC power distribution within AV equipment rack is covered under the AV Systems Contractor’s bid submittal).
2. AV system conduit, junction boxes, pull boxes and low voltage box eliminators (ring & string).
3. Analog or digital telephone/LAN equipment, cabling, outlets, connections, services and any third-party licenses for connection to AV equipment.
4. CATV services, distribution, cabling, connections and any required CATV tuner equipment.
5. General building lighting system including dimming equipment and low voltage control.
6. All furniture and millwork – unless specified as provided by AV Systems Contractor as part of that scope of work.

1.3 QUALIFICATIONS

A. Qualification of Bidder: The Owner's Agent may make such investigation as they deem necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish all such information and supporting documents as may be requested. The Owner's Agent reserves the right to reject any bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the Owner's Agent that such bidder is properly qualified to carry out the obligations of the contract and to complete the work contemplated therein within the project schedule and constraints. Conditional bids will not be accepted. Each bid must be accurate and valid for a period of sixty (60) days following the date established for the receipt of bid.

B. Specific Bidder Qualifications: An acceptable, qualified bidder must meet the following guide lines to be considered eligible.

1. Bidding AV contractor must be licensed in the state of Maryland as required to perform the work included in this specification at the time of bid submittal.
2. Bidding AV contractor must be capable of providing manufacturer-specified installation, programming, training, maintenance and repair for all equipment provided.
3. Bidding AV contractor must retain the following AVIXA certifications: (proof of certification to be submitted with bid)
   a. Full time resident system engineer must hold CTS-D certification.
   b. Full time resident project manager must hold CTS-I certification.
   c. Full time resident lead install technician must hold CTS certification.
4. Bidding AV contractor must have at least one (1) full time employee that is factory trained and certified to install, program and commission the specified digital audio signal processing equipment at the time of bid submittal. Proof of certification must be provided with bid.

The following information MUST be submitted with each bid submittal:
1. List of five (5) projects similar to the scope of this project.
2. Names and resumes of key project personnel that will be assigned to the project (Project Salesperson, System Engineer, Project Manager, Lead Installer, Control System and Digital Signal Processor Programmer).
3. Minimum of three (3) Project References with valid contact information.

D. Bid Submission: Submit a complete and accurate listing of all equipment to be used in assembling the specified system(s). Clearly identify equipment not listed in the specification (either substitute equipment or additional equipment required to meet the design intent).

Include the following items in the bid submittal – listed separately:
1. Itemized cost of all system equipment and associated installation labor.
2. Itemized cost of any optional equipment and associated installation labor.
3. Include standard one (1) year warranty, as specified in Section 3.0.
4. Include one (1) additional year of support/general maintenance, providing two (2) visits within twelve (12) months following completion.
5. Include cost for any required low voltage permits.

Such an Installer with the qualifications listed above is:

E. Audio-Video Group, LLC
8415 Progress Drive, Suite G
Frederick, MD 21701

who shall act as a Sub-Contractor to the Electrical Contractor. All services and fees associated with the use of this Sub-Contractor shall be included in the Electrical Contract.

PART 2 PROJECT SCOPE OF WORK

2.1 PROJECT SCOPE OF WORK
A. **Audio System:** Furnish and install a new audio system in the new Main Auditorium as specified. The system consists of a digital audio mixing system with digital snake units located at the equipment rack and on the stage. The new audio mix station is located in the rear of the room in the tech booth. Main loudspeakers are large point source loudspeakers with subwoofers installed near the stage. Input sources will be a mix of wired microphones, wireless microphones and playback sources. An RF based assistive listening system is included for the Venue. The audio system will drive additional new speakers in the green room, the mezzanine and the outdoor patio area, as well as powered stage monitors. There will be an additional input to the system from the DJ console location (no DJ equipment is included in this project.) The audio system will be configurable for a variety of events from a simple lecture to full concerts. There will be an “automatic” setting for the stage microphone jacks and the four wireless microphones, permitting unattended operation for an event either on the main floor or on the mezzanine.

B. **Video System:** Furnish and install a new video system in the new Student Venue as specified. The system consists of a DLP laser projector mounted from the ceiling and a motorized screen mounted on the wall behind the stage. There will be three flat panel displays, one in the mezzanine and two mounted on the mezzanine half-wall overlooking the main floor. Two outdoor video walls will be located on the south wall of the Venue overlooking the patio. HDMI inputs to these devices will be located around the Venue as well as content from a Blu-Ray player and a cable box (owner provided.) The video walls may also receive digital signage content provided by the University (exact details not available at this time.) Video signal routing will be accomplished by a matrix switcher located in the equipment rack. Source selection as well as full system control will be accomplished via the three provided touchpanels.

C. **Lighting System:** Install two (2) owner furnished lighting trusses at locations specified on the drawings. The trusses are Milos M290B 12” square, each 30’ long. The owner furnished truss may need to be augmented with additional sections, fittings, or accessories to achieve desired lengths and intended use. Provide and install new lighting instruments and DMX cables as specified in the lighting equipment list. Provide and install DMX cabling as detailed on the drawings.

2.2 **EQUIPMENT DETAIL**

A. **Product Substitutions:** Bidders may substitute equipment makes/models provided the substitution meets or exceeds the specifications of the original equipment. Any substitutions must be noted and supporting documentation provided. Owner reserves the right to reject any/all substitutions.

B. Coordinate and verify the final color/finish of any exposed equipment prior to purchase.

C. Provide rack-mounting hardware for any associated rack-mounted items, including proper cooling/ventilation for rack.
D. AV Contractor must provide/supply necessary software licensure for all applicable products.

E. AV Contractor must provide EASE® data (coverage and intelligibility plots) showing aiming detail for main loudspeakers, prior to installation.

F. Auditorium Equipment List:

<table>
<thead>
<tr>
<th></th>
<th>Company</th>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>QSC-CORE</td>
<td>110F</td>
<td>Unified Core with 24 local audio I/O channels, 128x128 network I</td>
</tr>
<tr>
<td>1</td>
<td>QSC</td>
<td>Dante Card</td>
<td>5000 Series Receiver (3rd Gen)</td>
</tr>
<tr>
<td>8</td>
<td>Audio-Technica</td>
<td>ATW-R5220DANDF1</td>
<td>5000 Series (3rd Gen) BP TX</td>
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<td>16</td>
<td>Audio-Technica</td>
<td>ATW-T5201DE1</td>
<td>5000 Series (3rd Gen) HH TX</td>
</tr>
<tr>
<td>16</td>
<td>Audio-Technica</td>
<td>ATW-T5202DE1</td>
<td>5000 Series (3rd Gen) HH TX</td>
</tr>
<tr>
<td>1</td>
<td>Audio-Technica</td>
<td>ATW-C3300</td>
<td>Interchangeable Mic Capsule</td>
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<td>1</td>
<td>Allen &amp; Heath</td>
<td>AH-SQ-7</td>
<td>96kHz XCVI FPGA processing, 48 Input Channels, DEEP Processing R</td>
</tr>
<tr>
<td>2</td>
<td>LUXUL</td>
<td>AGS-1024</td>
<td>AV Series 24-Port Gigabit Rack Mount Switch</td>
</tr>
<tr>
<td>1</td>
<td>Allen &amp; Heath</td>
<td>AH-DX-HUB</td>
<td>Standalone trunk connections to gigaACE card in any dLive I/O po</td>
</tr>
<tr>
<td>2</td>
<td>Allen &amp; Heath</td>
<td>AH-DX164-W</td>
<td>Wall box I/O Expander 16 Mic/Line in, 4 Line out (DX Ports), Con</td>
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<td>1</td>
<td>Allen &amp; Heath</td>
<td>AH-DX168</td>
<td>16 x 8 audio expander with dLive 96kHz mic preamps, 96kHz/48kHz</td>
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<td>Allen &amp; Heath</td>
<td>AH-M-SQ-SDANTE-A</td>
<td>64 X 64 SQ Dante Card 96kHz / 48kHz</td>
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<tr>
<td>2</td>
<td>Community</td>
<td>LVH-900</td>
<td>L-Series, Beamforming Venue Horn</td>
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<tr>
<td>2</td>
<td>Community</td>
<td>ALC-404D</td>
<td>4 Channels x 400W + DSP and Dante</td>
</tr>
<tr>
<td>2</td>
<td>Community</td>
<td>ALC-1604D</td>
<td>4 Channels x 1600W + DSP and Dante</td>
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<tr>
<td>2</td>
<td>Community</td>
<td>IS8-218B</td>
<td>HIGH POWER DUAL 18-INCH SUBWOOFER BLACK</td>
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<tr>
<td>2</td>
<td>Community</td>
<td>ALC-3202D</td>
<td>2 Channels x 3200W + DSP and Dante</td>
</tr>
<tr>
<td>2</td>
<td>RCF</td>
<td>ST12-SMA</td>
<td>Active 12&quot; 2-way Stage Monitor</td>
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<td>Marshall</td>
<td>CV620-NDIW</td>
<td>HD NDI PTZ IP 3GSDI HDMI Camera - White</td>
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<td>Middle Atlantic</td>
<td>ERK-4420</td>
<td>44SP/20D Standalone Rack</td>
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<td>1</td>
<td>Middle Atlantic</td>
<td>EWR-16-22</td>
<td>16SP/22D Econo Wallr</td>
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<td>2</td>
<td>Sharp</td>
<td>PN-LE901</td>
<td>90&quot; LCD TV 1920X1080 350CD/M2, USB Media Player</td>
</tr>
<tr>
<td>2</td>
<td>Hisense Pro</td>
<td>55U1600</td>
<td>55&quot;LED ULTRA HDTV,4k,HDR,RS-232c,4-HDMI,2-USB, TAA,</td>
</tr>
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<td>2</td>
<td>DELL</td>
<td>P2719H</td>
<td>Dell P-Series 27&quot; LED (P2719H)</td>
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<tr>
<td>1</td>
<td>VIVTEKUSA</td>
<td>DU8190Z-BK</td>
<td>8000lm laser</td>
</tr>
<tr>
<td>1</td>
<td>VIVTEKUSA</td>
<td>3797744200-</td>
<td>Standard Zoom</td>
</tr>
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</table>
SVK
1 Extron 60-1434-01 IPCP PRO 555
2 Extron 60-1341-02 TLP Pro 1220TG
1 Extron 30-1340-02 TLP Pro 1220MG Blk
1 LUXUL ABR-5000 Epic 5 Gb Router Back Ports
1 LUXUL AGS-1024 AV Series 24-Port Gigabit Rack Mount Switch
1 NET MS4300-52 ProSAFE, 10Gb, POE+, 48 port
9 Extron 60-1525-12 NAV E 101
10 Extron 60-1525-14 NAV SD 101
1 Extron 60-1534-01 NAVigator
1 Extron 79-2551-02 LinkLiscense
1 Extron 03-001-01 Extron Commissioning
1 Extron 03-016-01 Extron Travel

Connection Plates
All plates, including Decora cover plates, to be aluminum anodized black with white engraved lettering

PART 3 EXECUTION

3.1 PROJECT PROCESS – AFTER PROJECT AWARD

A. **Shop & Field Drawings**: Submit custom engineering pertaining to this project to Owner’s Design Team for approval before actual purchase, assembly, or installation of equipment:
   1. Product data sheets of any proposed substitute equipment to be furnished with bid.
   2. Block diagrams indicating the proposed interconnection of all equipment to be furnished – clearly noting any proposed design changes or modifications.
   3. System conduit drawings for any additional conduit that has not been provided within the Contract Drawings.
   4. Equipment rack layout and all details concerning cabinets, consoles, tables, carts, support bases and shelves.
   5. Mounting details for all permanently installed equipment. Details for mounting equipment greater than 250 lbs. may require approval by a structural engineer. Rigging of all system devices that are suspended must adhere to a strict 7:1 safety ratio.
   6. Shop drawings for custom fabricated plates, panels and designation strips. Drawings shall include locations and types of connectors, engraving information, and plate material, finish and color.
   7. Cabling identification plan.
   8. Remote control touchpanel page layouts for functionality.
   10. Other information as appropriate or as required in other sections of this Specification.
The Shop & Field Drawing submittal must be received by Owner’s Design Team a minimum of thirty (30) days prior to the AV Systems Contractor expected fabrication start date to allow time for proper review, revision and resubmission, as necessary.

3.2 PROJECT EXECUTION

A. Prior to site installation, representatives of the Owner’s Design Team may visit the AV Systems Contractor’s shop to inspect all off-site rack fabrication work. Plans shall be discussed for on-site installation at that time.

B. Coordinate the installation of all equipment, wiring, and associated hardware to be compatible with the work of other trades and with the overall construction completion schedule. The AV Contractor shall coordinate all access and work with the Owner in advance. The AV Contractor is responsible for protection of Owner’s finishes, furniture, and equipment, and shall maintain a clean work environment while working and when finished each day.

C. Perform installation in strict accordance with standard industry practices, the National Electrical Code, and any other governing codes.

D. Keep a complete and accurate set of installation drawings at the job site. Note any changes made during installation on the drawings. Include a final set of as-built drawings with the Operation and Maintenance manuals.

E. Install all equipment following the manufacturers' recommendations and industry standards. Adjust and test to assure that all components are functioning properly by themselves and in conjunction with their associated components.

F. Install all equipment in appropriate cabinets or consoles at the locations designated in this document or on the associated contract drawings.

G. Securely fasten and support all equipment without hindering equipment operation.

H. Permanently label all system controls, equipment, switches, connectors, wall/floor plates, etc. for easy identification. Document all equipment settings that normally do not require readjustment in the Operation and Maintenance manuals.

I. Utilize signal and power grounding techniques in accordance with established industry standards, such as set forth by AVIXA and its CTS certification program.

J. Field-verify the final location of all equipment prior to installation.

K. Affix a one (1) rack space panel to each rack identifying the AV System Contractor with clear contact information which provides the end-user access to support and service in case of emergency or system failure.
L. The AV Contractor is responsible for cleanup and disposal of all waste materials daily. Wherever possible, materials (including packaging, waste cabling, connectors, etc.) shall be properly recycled. Use of General Contractor provided dumpsters and recycling facilities shall be provided to the AV Contractor.

M. All voltages, except for the primary power to the power supply circuits, shall not exceed 70.7 VAC Root Mean Squared (RMS) or 100 V direct current (DC).

N. Install the system in a manner that allows for future audiovisual equipment to integrate easily into the overall desired system design, properly routing all audio, video, control and structured cabling elements of the final design in an industry acceptable manner that preserves the architectural and visual integrity of the building.
   1. Cabling for microphone and line inputs, video, control and other audiovisual related cabling shall be routed inside the comprehensive system of conduit indicated on the drawings and installed by others. The exceptions to this requirement are cables which connect to ceiling mounted/suspended devices, in which case cabling shall be free-air, attached to building structure as applicable. Wall boxes shall serve as the primary interface points to the audiovisual system.
   2. Provide and install cover plates, connectors and associated cabling to link all wall boxes to all affiliated local and remote audiovisual components. The Owner will provide no additional conduit, power or workboxes. If additional infrastructure is required, include provisions for what is additionally required in the proposal. No Wiremold or surface mounted raceway will be permitted.

O. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

P. Delivery, Storage, and Handling:
   1. Supply, transport, deliver, unload and move to the installation location, unpack, place, assemble, secure, connect and install all equipment needed to complete the installation. Transportation, parking, delivery and on-site storage of the system’s equipment shall be the responsibility of the AV Contractor. The AV Contractor is also responsible for all transportation of personnel to and from the site.
2. The actual dates of delivery shall be under the absolute control of the Owner. The dates and times for delivery and installation are critical to the successful completion of the project. Deliveries shall normally be accepted only Monday through Friday 8:00 am to 4:00 pm. It may become necessary for goods to be installed outside these hours and comply with the instructions of the Owner. Deliveries attempted outside these hours without prior consent of the Owner may be turned away. Comply with all instructions of the Owner and the Project Manager concerning time of arrival at the site; which entrance shall be utilized for delivery; routes to be taken to reach the installation locations; and other matters relating to the orderly and timely installation of the system.

3.3 SYSTEM WIRING

A. All wiring runs shall be installed as complete un-spliced cable runs where possible. Splices shall not occur in conduit.

B. Provide plenum-rated cable where required by code.

C. Utilize minimum 22 gauge twisted pair shielded wire for all unbalanced line level connections. Utilize minimum 22 gauge twisted pair shielded wire with a minimum 24 gauge drain wire for all balanced line level or microphone level connections. Multi-conductor cable shall provide a 100% shield for each pair.

D. Utilize minimum 12 gauge twisted pair unshielded wire for all primary speaker array connections. Size and run wire to provide a line loss of less than .5 dB.

E. Utilize minimum 14 gauge twisted pair unshielded wire for outdoor/patio speakers.

F. Utilize minimum 16 gauge twisted pair unshielded wire for all remote speakers.

G. Utilize standard 75-ohm shielded coaxial cable for all analog video/computer wiring. Size and run wire to provide a line loss of less than 1.5 dB. Color code BNC cables according to industry standards.

H. Acceptable installation cable manufacturers include Extron, West Penn Wire, and Blizzard.

I. All digital cabling shall be selected to allow 4K signal resolution at the display with an industry standard test generator utilized as a source.

J. CAT-X transceivers shall be utilized to achieve the above cabling specifications based on actual cabling distances or other field conditions. The AV Contractor shall alert the Design Team of any signal paths that may require the use of such transceivers if not already specified.
K. Arrange, route, and isolate wiring according to signal level to minimize crosstalk, hum, or spurious signals. Wiring categories shall consist of microphone level (-80 dBm to -20 dBm), line level (-20 dBm to +30 dBm), loudspeaker level (+30 dBm and above), AC power, and DC control or emergency power.

L. Install all cabling in an orderly and professional manner. Provide service loops to allow access to the rear of equipment. Audiovisual cables shall be installed and fastened without causing sharp bends or rubbing of the cables against sharp edges. Cables shall be fastened with hardware which will not damage or distort them.

M. Label each cable in the system (on both ends) in a clear and permanent manner. Use a logical labeling system that maintains the same circuit designation from origin to destination.

N. Utilize shielded cabling and connectors for any connections as specified by the equipment manufacturer.

O. Materials and work specified herein shall comply with the applicable requirements of:

3.4 SYSTEM PERFORMANCE STANDARDS

A. Performance Standards: Unless restricted by the published specification of a particular piece of equipment, or unless otherwise required, the following minimum performance standards shall be met by the audiovisual system:
   1. Audio
      a. S/N (including crosstalk and hum): 75dB minimum.
      b. Total Harmonic Distortion: 0.5% maximum from 30 Hz to 15,000 Hz.
      c. Frequency Response: Flat within +1.0 dB, 30 Hz to 15,000 Hz.
   2. Display
      a. Minimum 15:1 contrast ratio.
3. Video
   a. S/N (peak to RMS), unweighted DC to 4.2 MHz: 45 dB minimum.
   b. Crosstalk, unweighted DC to 4.2 MHz: 45 dB minimum.
   c. Frequency Response (RGBHV): Within +0.5 to 300 MHz.
   d. Frequency Response (composite): Within +0.5 dB to 10 MHz.
   e. Frequency Response (component): Within +0.5 dB to 100 MHz.
   f. Line and Field Tilt: 2% maximum.
   g. Different Gain: 3% maximum.
   h. Different Phase: 2 degrees maximum.
4. Performance Test Signal Paths: The signal paths for the above Performance Standards shall be as follows:
   a. Audio: From any source input (microphones, etc.) through all, distribution amplifiers, etc., to all signal destinations.
   b. Video: From any source input (computer, DVD units, etc.) through all processors, distribution amplifiers, etc. to all signal destinations.

B. Test Equipment List:
   1. The AV Contractor is responsible for furnishing all test equipment required to test the system in accordance with the parameters specified. Unless otherwise stated, the test equipment shall not be considered part of the system. The AV Contractor shall furnish test equipment of an accuracy better than the parameters to be tested.
   2. The test equipment furnished by The AV Contractor shall ideally be the following, as relevant:
      a. Oscilloscope
      b. Spectrum Analyzer with calibrated microphone
      c. Signal Level Meter
      d. Volt-Ohm Meter
      e. SPL Meter
      f. Impedance Meter
      g. Sine wave and random Noise Generator
      h. Audio Amplifier with external speaker

3.5 SYSTEM PRE-COMMISSIONING

A. Prior to formal system commissioning with the Owner and Design Team, the AV Contractor shall provide preliminary testing to determine if the systems are substantially complete. These tests shall include a minimum of the following, as appropriate:
   1. Verify that all equipment has been delivered and installed per specifications. Provide a detailed equipment list sorted by room number and rack complete with make, model and serial number.
   2. Verify that all other trades have completed the work associated with the functioning of the audiovisual systems and that any installed third-party devices (screens, shades, lights, etc.) work properly with the AV systems.
   3. Power on all equipment and verify the intended functions.
4. Verify signal paths and cable continuity/integrity for all field terminated wiring.
5. Adjust and align all displays for color, contrast, and geometry.
6. Verify communications services (POTS, ISDN, VoIP, Ethernet, etc.).
7. Load and test all DSP and control system software and provide button by button testing of all control system touch panels.

B. Provide documentation to the Owner certifying that the systems are substantially complete.

3.6 FINAL COMMISSIONING/ACCEPTANCE TESTING

A. After preliminary system installation and adjustment conduct an Acceptance Test with representatives from the Owner and Design Team present.

B. Schedule commissioning through the Owner to ensure the availability of all required personnel and rooms.

C. During the commissioning, the AV Contractor shall demonstrate the operation of each individual piece of equipment in the system, and of the system as a whole. The AV Contractor shall demonstrate that equipment functions according to manufacturer’s specifications, industry standards, and as stated in this Specification Section.

D. This demonstration will include a minimum of the following as applicable:
   1. A physical inventory of all equipment
   2. An evaluation of general workmanship and construction quality
   3. A mechanical check of all system components
   4. The physical operation of all system equipment (audio, video, control and network) including button-by-button control system testing
   5. The placement of audio and video test calls, if applicable

E. The AV Contractor shall provide all required test media to support the commissioning including high quality legal copies of audio and video source material in all appropriate formats and blank recordable media in all appropriate formats.

F. A punch list shall be prepared in cooperation with the Design Team indicating all incomplete work and/or items needing attention including the course of action and dates for a resolution.

G. At the conclusion of the Acceptance Test, using the generated punch list (or discrepancy list) the Owner and the AV Contractor shall jointly agree to the results of the test, and reschedule testing on deficiencies and shortages, if any, with the Owner. Any retests that are needed to reach agreement on the results of these tests or to later establish compliance with these specifications will be done at the AV Contractor’s expense.
3.7 PROJECT CLOSEOUT AND FINAL SUBMITTAL

A. Equipment Manuals:
   1. The AV Contractor shall deliver to the Owner; one (1) complete set of product manuals for each item of equipment furnished as part of the systems. The manuals shall detail the theory of operation and shall include narrative descriptions, pictorial illustrations, block and schematic diagrams.

B. As-Built Drawings:
   1. The AV Contractor shall deliver to the Owner, two (2) complete sets of as-built wiring diagrams of the system. The diagrams shall show all inputs and outputs of electronic and passive equipment correctly identified according to the markers installed on the interconnecting cables, equipment and room/area locations.
   2. The as-built wiring diagrams shall be in hard copy on standard 36" x 24" pages (ARCH D) and two electronic copies (USB drive) in AutoCAD (.dwg) and Adobe Acrobat Portable Document Format (.pdf).

C. System Operation Manual:
   1. Produce this manual specifically for the system detailed herein. The manual shall describe all procedures necessary to activate the system to provide for the functional requirements, except as specifically excluded by the Owner. This section shall provide a non-technical graphic and narrative "how-to" users guide for the procedures needed to operate the system. The document shall contain a section on operating the system's equipment in the event of control system failure. Control system touch panel layouts shall be accompanied by narrative text describing step-by-step function engagement.
   2. Provide three sets of manuals detailing the installation, operation, and service of each audiovisual system. One set shall be in hard copy form and two shall be electronic (USB drive).
   3. The manuals shall be clearly indexed and contain a minimum of the following as applicable:
      a. As built drawings as described in Section B above. Drawings shall be of an appropriate size to allow all text to be clearly legible. Electronic copies shall be in .dwg and .pdf formats.
      b. List of provided equipment in Excel and .pdf format. List shall be organized by room # and shall include quantities, rack locations, and serial numbers.
      c. Telephone numbers and IP addresses of all voice or data lines into the rooms.
      d. Manufacturer's instruction manuals.
      e. Manufacturer's service instructions.
      f. Manufacturer's warranty information.

3.8 FINAL COMMISSIONING/ACCEPTANCE TESTING
A. Conduct on-site training programs to instruct the Owner on overall system and individual equipment operation, basic preventative maintenance, and basic system troubleshooting.

B. Provide a nominal 6 hours of training which may be scheduled at the Owner’s request at any time up to 90 days following system acceptance.

C. Provide a minimum of two training sessions:
   1. The first session shall occur immediately after the acceptance of the systems and cover the basic operation of each system.
   2. Provide the second training session within four weeks from the first session. The operation and maintenance manuals for the equipment shall be completed and presented to the client at this time. This training session will be used to train additional people and/or to answer questions/resolve issues developed within the first weeks of system use.

D. Provide in the bid submittal an hourly rate, valid for one year from the acceptance date of the system installation, for any requested additional training or operation assistance (above and beyond the 6 initial hours).

3.9 TECHNICAL ASSISTANCE

A. AV Contractor must attend the first student concert event after completion of system installation. AV Contractor must have present a skilled technician that is knowledgeable with all equipment installed to provide operational advice to students/attendants for the duration of this first event. Ample and appropriate scheduling will be coordinated with the Owner during the project’s installation phase.

3.10 WARRANTY

A. Guarantee the system for a period of one year from the date of final system acceptance against defective materials, design, workmanship, and improper adjustment. Repair or replace any defective material at no expense to the Owner. During the warranty period, respond to any service calls within 24-hours (excluding Saturdays, Sundays, and holidays). Where possible, provide substitute equipment to maintain system operation during repair.

B. The above warranty shall not void warranties issued by individual equipment manufacturers. Individual warranties valid for greater than one year shall remain in full effect.

C. The above warranty shall not void any rights guaranteed to the Owner by law.

D. The above warranty shall not pertain to existing owner-provided equipment.

3.11 MAINTENANCE
A. Provide (2) service calls after the acceptance of the system at months 6 and 12 to perform routine system maintenance and adjustment.

B. Work Not Included:
   1. Maintenance and repair service shall not include the performance of any work due to improper use; accidents; other vendor, contractor, or owner tampering; or negligence for which the AV Contractor is not directly responsible and does not control. The AV Contractor shall immediately notify the Owner upon the discovery of these incidents, verbally and in writing. The Owner will investigate all reported incidents and render findings concerning any AV Contractor responsibility.

3.12 ATTACHMENTS

A. List of drawings
   1. AV201 Device Locations
   2. AV601 AV Connection Plate Details
   3. AV701 AV Rack Elevations
   4. AV901 AV Audio Schematic
   5. AV902 AV Video Schematic

END OF SECTION
DIVISION 28

ELECTRONIC SAFETY AND SECURITY
PART 1 GENERAL

1.1 SUMMARY

A. This section includes furnishing, installation, commissioning and testing of an Integrated Access Control Security Management System (ISMS).

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following sections contain requirements that relate to this Section:
   1. Division 28 Section “Digital, Addressable Fire-Alarm System” for coordination and interface with fire alarm system.
   2. Division 28 Section “Intrusion Detection” for coordination and interface requirements.
   3. Division 28 Section “Video Surveillance” for coordination and interface requirements.
   4. Division 26 Section “General Electrical Requirements.”
   5. Division 26 Section “Grounding and Bonding for Electrical Systems” for grounding, requirements of equipment.
   6. Division 26 Section “Low-Voltage Electrical Power Conductors and Cables” for cabling requirements.
   7. Division 26 Section “Raceways & Boxes for Electrical Systems” for conduit, raceway and box requirements.
   8. Division 27 Section “Telecommunication Systems” for coordination with telephone system, network and communication voice cable requirements.

1.3 SUMMARY OF WORK INCLUDED

A. Coordinate all related work specified elsewhere with the access control system.

B. Materials
   1. Furnish and install at locations that show the specified equipment to provide a completely operational Integrated Security Management System without additional cost to the OWNER.
   2. The following list of main items of the installation shall not be considered to be all inclusive:
      a. Smart Card Readers and Cards.
      b. Reader modules.
      c. Output relays.
      d. Zone inputs.
e. Alarm monitoring panels.

f. Intelligent controllers.

g. Software.

h. Client workstation set-up.

i. Wire for readers/panel communication.

j. Surge and noise suppressors.

3. Provide and install all equipment, components, wire, cable, and mounting hardware as required to meet manufacturer’s specifications and documented installation procedures.

4. Provide all accessories and misc. items required for an operating system.

5. Installer shall meet the entire intent of these specifications and associated drawings. Deviations from specified equipment and/or operation of the system shall not be permitted.

1.4 SYSTEM DESCRIPTION

A. The Integrated Security Management System (ISMS) shall be part of a modular, networked access control system capable of handling large facilities with multiple remote sites, alarm monitoring, video imaging, badging, paging, guard tour, digital video servers and CCTV switcher control. The system shall allow for easy expansion or modification of inputs, outputs, and remote control stations.

B. The system control at the central computer location shall be under a single software program control, shall provide full integration of all components, and shall be alterable at any time, depending upon the facility requirements. Reconfiguration shall be accomplished online through system programming, without hardware changes.

C. Operating Environment: The ISMS shall be a true 32-bit or 64-bit, 3-tier client/server, ODBC compliant application based on Microsoft tools and standards. The ISMS application shall operate in the following environments: Microsoft Windows® Server 2008 R2 SP1, Microsoft Windows® 7 SP1 (64-bit), Windows Server 2012 R2 and Windows 8.1 and Windows 10.

D. The software program shall consist of multiple servers including, but not limited to, Database Server, Communications Server, and Client Workstation Server. The Servers shall be capable of being installed on one or more PCs across a network providing a distribution of system activities and processes.

E. The system shall support multiple communication servers on a LAN/WAN, to provide distributed networking capabilities, which significantly improve system performance.

F. Regional database Management System: The Security Management System shall support industry standard relational database management systems. This shall include relational database management system Microsoft SQL Server 2012 Enterprise Edition. The RDBMS shall provide edit, add, delete, search, sort, and print options for records in the selected databases.
G. The system shall have the capability to communicate with the control panels via LAN/WAN connections utilizing industry standard TCP/IP communication protocol.

H. The system software shall allow support for multiple accounts allowing separate access to the card database, badge layout, operator access, and reporting. Physical hardware may be filtered by operator level into sites. (EXAMPLE: Filtering operator levels by sites helps prevent users from making unauthorized changes to other sites. An administrator operator at a remote school site account with five access control doors could only view and make changes associated with those five doors located at that site. The operator level could be filtered to inhibit unauthorized changes to other sites). Sites may reside in multiple accounts. The system shall allow control of common areas between accounts. Access levels and time zones shall be global to allow for easy administration. The global access levels and time zones shall be capable of being used by several accounts. Administrators shall have the ability to move cardholders from one account to another.

I. The software program shall use Abstract Devices (ADV) for representing hardware devices in the system. The ADVs shall be used in Floor Plans to provide the user interface to control and monitor the system, and shall also be used in the Data Trees to organize, display, and control system information. The CUSTOMER shall provide necessary floor plans to the CONTRACTOR.

J. The system shall support both manual and automatic responses to alarms entering the system. Each alarm shall be capable of initiating a number of different actions, such as camera switching, activation of remote devices, door control, and activation of WAV files.

K. The system shall provide both supervised and non-supervised alarm point monitoring. The system shall be capable of arming or disarming alarm points both manually and automatically, by time of day, and by day of week.

L. Access control functions shall include validation based on time of day, day of week, holiday scheduling, site code and card number verification, automatic or manual retrieval of cardholder photographs, and access validation based on positive verification of card, card and PIN, card or pin, pin only and Site Code only.

M. Alarm events with defined priorities shall be able to pop-up automatically in an Alarm event window for operator attention. The pop-up shall display the name of the event (reader, alarm point, cardholder or system alarm), time, date, site, account, if a card event the card number, type of event and cardholder name. An event counter shall also display the number of times the event was reported to the Alarm event monitor prior to Acknowledgement or Clearing the event. Event instructions shall be made available by double clicking on the event.
N. The Alarm event window shall allow the operator to initiate a physical response to the event as well as a written response. Responses shall include but not be limited to: acknowledge, clear, open a preprogrammed floor plan, energize, de-energize, pulse, time pulse, add comment, shunt or un-shunt.

O. Assigned passwords shall be possible to define the levels of system operation for each individual operator. System operation for individual operators shall include, but not be limited to, restricted time periods for login, available accounts and default language selection at login. Operator actions range from no view or control rights to basic monitoring to full control of the system including programming.

P. The system programming shall be user friendly, and capable of being accomplished by personnel with no prior computer experience. The software shall utilize drop boxes for all previously entered system-required data. The programming shall be MENU driven and include online “Help” or “Tutorial” information, as well as online data entry examples. The Help shall be available by using the F1 key. When using the F1 help access, the help menu will provide detailed information relative to the operation that the user is performing without the need to key in additional search parameters.

Q. The access system shall be integrated with the Honeywell Intrusion Detection System Access Control. Integration shall provide ability to arm/disarm intrusion system via card readers located beside each security keypad.

R. After installation, the OWNER shall be able to perform hardware configuration changes. These hardware configuration changes shall include, but not be limited to, door open time, door contact shunt time, point and reader names, when and where a cardholder is valid, and the ability to add or modify card databases as desired without the services of the CONTRACTOR or MANUFACTURER.

S. Equipment repair shall be able to be accomplished on site, by module replacement.

T. All control components shall utilize “Distributed-Processing” concepts. The distributed processing shall include the ability to download operating parameters to any field panel, thus allowing the field panel to provide full operating functions independent of the access control system computer.

1.5 SYSTEM CAPACITIES

A. The system shall require one master control file server station. The access control program running on the file server shall restrict the number of operator workstations working in a LAN/WAN based on the access software licensing. Licensing shall be by software activation monitoring concurrent connection and not require the use of hardware keys per workstation. The only restriction will be imposed by the operating system and hardware configuration. Operator workstations shall provide all functionality as available at the server with the exception of database maintenance functions.
B. The system software shall not use a hardware dongle unless required by the system hardware and then only on the PC where the database server resides. No dongles shall be required at any workstations.

C. Overall control of the access control, CCTV, paging, and alarm monitoring shall be through software control, which provides complete integration of the security components.

D. The file server station shall operate in both a programmed and a manual mode.

E. The system shall be expandable in modular increments to total capacity. The software shall not require installation of any module or any other upgrading to achieve above stated capacities. Unrestricted number of operator workstations and multiple communication servers shall be supported as a standard feature of the WIN-PAK PRO PE access control software.

1.6 BASIC SYSTEM CAPABILITIES

A. The following functional capabilities are considered essential for the system described in this specification. The capabilities are to be considered standard, without the need for add-on software or hardware.

1. All databases will have the ability to ADD, DELETE, REPORT, VIEW or EDIT information.
2. Provide storage of all system transactions in a retrievable file.
3. Log all events by time and date.
4. Provide capability to store all or selected system transactions to a disk file.
5. Provide ability for CUSTOMER to make system configuration changes such as, but not limited to door open time, door contact shunt time, point and reader names, when and where a cardholder is valid, and the ability to add or modify card databases at any time.
6. Support “Global Anti-passback”, allowing cardholder to enter/exit any such defined card reader on the same intelligent control panel or RS-485 drop line consisting of 2 or 4 door controllers.
7. Anti-passback modes shall include hard (no forgiveness), soft (allows access but generates an alarm event) and timed for all readers on the intelligent controller, on specified reader or card for a definable period of time up to 32,000 seconds.
8. Two card holder rule, where two valid, non-identical cards must be used within a 20 second period of time to grant access.
9. Ability to display when a card holder who uses the reader has accessed (opened) the door or if the card was used but the door was not opened.
10. Ability to select appropriate doors to remain locked even though it is programmed by time zone control to be unlocked, until the first valid card read is seen during the door’s time zone at which time the door will remain unlocked for the duration of its defined time period.
11. Latch mode operation where the first card read unlocks the door and the second causes it to lock the door.
12. Provide mode of system operation that stores system commands that were not accepted by the hardware.
13. Provide mode of system operation that requires the operator to enter a response to an event when acknowledging it from the alarm view window.
14. Provide mode of system operation that allows acknowledged alarms to be automatically cleared.
15. Provide mode of system operation where un-acknowledged events will cause the computer to continuously emit a pulsating beep until all un-acknowledged alarms are acknowledged. A momentary silence feature shall allow the beeping to cease for up to 60 seconds. The silence feature shall also provide a visual count down to when the beeping will begin again.
16. Provide mode of system operation where when an acknowledged, but not cleared event will be reissued requiring acknowledgement when the event changes to an alarm or trouble state.
17. Provide mode of system operation that does not allow the operator to clear an alarm prior to it being restored to normal.
18. Provide ability for manual operator control of system output relays. The manual functions shall include the ability to energize, de-energize, return to time zone, or pulse the output relay. The pulse time shall be a programmable setting.
19. Provide ability for manual operator control of system doors. The manual functions shall include the ability to Lock, Un-Lock, Disable, Card only, Card- Pin only, Pin only, exit only and site code only.
20. Provide ability to automatically display stored “video image” of cardholder.
21. The cardholder “video image” pop-up shall be activated based on a priority level set to the cardholder or reader. Information in the pop-up shall include, but not be limited to the card holder’s primary image a live video pop-up showing the person who initiated the pop-up, entrance name, time, date, cardholder name, and status. User shall be able to display up to 40 note fields. The size of the pop-ups shall be adjustable by the operator.
22. Support multiple card reader technology including:
   a. Smart Card
   b. Wiegand effect
   c. Biometrics
   d. Magnetic stripe
   e. Bar code
   f. Keypad
   g. Card/keypad (PIN)
23. Provide a means for scheduled automatic backups of any or all database system files. A means to restore these files from a simple menu shall exist.
24. Provide the ability to address up to 255 serial communication ports per communication server, where each port can be configured for either hardwired or dial-up. When configured for dial-up, any one port can support multiple dial-up locations.
25. Communication from the access control communication server to the remote intelligent control panels shall be selectable. Communication options shall be RS-232 directly to the intelligent control, via RS-485 converter, dial-up, leased line from a defined communication port or by LAN/WAN using an IP address for direct connection to the intelligent controller via network interface card. When using IP addressing it shall be un-acceptable to use a communication port converter device on the communication server side of the transmission. A minimum of 255 such IP connections shall be allowed per communication server.

26. All commands and updates to the panels shall be verified and shall automatically retry if communications have failed.

27. Provide a system scheduler that shall automatically:
   a. Call remote locations to retrieve history transactions and update panel information, including time and date.
   b. Activate or deactivate cards locally or at remote dial-up sites.
   c. Initiate a preprogrammed command event/action.
   d. Synchronize system to intelligent controller time.
   e. Run a pre-defined (template) History or Card Holder report.
   f. Card frequency report defined by reader(s), over a defined period of time with disposition options to automatically report or report and de-activate card or change the access level of the card.
   g. Frequency shall be defined as Never, Now, Once, Hourly, Daily, Weekly, Once per 2 weeks, and Monthly.

28. Provide drop boxes for all system-required information that the user has previously entered.

29. Provide the ability to initiate an email (via SMTP) or page to a paging system based on a transaction state. A transaction state shall be defined as but not limited to Normal, Alarm, Trouble, Ajar, Trace, Not Found, Anti-Passback Violation, PIN Violation, Time Zone Violation, Site Code Violation, Door Used, Duress, No Second Card Presented, Trace Card or Expired Card, and System Alarms including, Panel Com, Panel Power Failure, Modem Pool, Guard Tour, and Tamper.

30. A host grant mode of operation shall exist that requires the host computer to grant accesses to “valid” cards. An alternate host grant mode shall allow the card access information to be downloaded along with unlocking the door for “valid” cards.

B. Card Database

1. Provide a simple card and card holder database import utility. The utility shall be password protected and accessible only to administrators of the access control system. Information that can be imported shall include but not be limited to: First Name, Last Name, card number, activation date, de-activation date, status, up to 40 note fields and photo images. A simple CSV (comma separated value) file shall be used for the importing of data and image file name.

2. Cardholder information shall include unique card number up to 15 digits and optional Personal Identification Number.

3. Allow multiple cards per cardholder.
4. Provide 40 user definable fields.
5. Provide special card options that include, but are not limited to:
   a. Time zone reference, which defines valid time.
   b. Visitor use, which provides a specified activation date and expiration
date (spanning years).
   c. Trigger control value, which can initiate a predefined procedure at the
intelligent control independent from any control function from the
system computer.
6. Provide a card “Trace” function. The Trace function shall allow normal
access control, but will provide a tracking alarm at the system monitor.
7. Provide ability to store digital images of cardholder or other digital images
such as property or family members. Up to 99 such images shall be
associated with the cardholder.
8. Provide ability to store a written signature of the cardholder or other
signatures such as family members. Up to 99 such signatures shall be
associated with the cardholder.
9. Provide the ability to prioritize specific card usage from 1 to 99 with separate
priority options shall included but not be limited to Anti-passback, Trace,
PIN Violation, Normal, Not Found, Expired, Host Grant, Site Code and
Time Zone card activities or violations.
10. Allow the user the ability to assign an operator message per card event state
and a procedure for the intelligent control shall perform per event state.
11. Upon editing card information, the updated information shall be sent
automatically to the appropriate access control panel, when hardwired, with
no other user intervention. If the port is dial-up, the entry will be stored on
disk and shall be updated when connection is made to the remote loop. If the
scheduler is used, then card updates shall be sent based on scheduling.
12. In a traditional (Wiegand) 5 digit card database, the numbers 0 and 65,535
shall not be valid card numbers as some devices transmit these numbers on
an improper read.
13. In a 15-digit card database, the number 0 shall not be a valid card number as
some devices transmit this number on an improper read.
14. A card shall have the ability to be allowed to access one or selected accounts
up to all available accounts.

C. Access Levels
   1. Provide the ability to define specific times of access.
   2. Provide the ability to define specific readers for access.
   3. Provide a template of a defined access level detail, where changes can be
made to the template and saved as a new access level detail.
   4. Provide an access control tree structure that allows groupings of entrances.
User shall have the ability to group program all entrances on the branch or
make specific changes to individual entrances.

1.7 SUBMITTALS

A. Provide submittal data for each system, as follows:
   1. To verify specifications have been met.
2. Clearly indicate or state all options, etc.:
   a. Manufacturer/cat. number.
   b. Manufacturer’s options.
   c. Accessories.
   d. Indicate point of connections with other equipment or systems.
3. Bill of materials showing equipment quantities and model numbers.
4. Manufacturer's technical information sheets on all proposed equipment.
   a. Highlight or clearly indicate all items to be provided.
   b. Include wire/cable specifications.
5. Proof of component and system UL Listing.
6. Provide proof of required certifications and installer qualifications.
7. Drawings:
   a. Riser diagrams showing all devices and wiring types. Indicate all points of connection between Access System and Intrusion Detection System.
   b. Wiring connection diagrams for each proposed component.

B. Closeout Submittals: Submit in accordance with the General Condition Requirements and as follows:
1. Operational Information: Provide full instruction manual to cover all aspects and components of the installed system and to be used to supplement the Owner Demonstration.
2. Maintenance Data: Provide for all equipment and accessories to include in the "Operating and Maintenance Manual" specified in Division 1.
   a. Include recommended periodic tests of equipment in service, and test parameters. Provide manufacturer’s recommended test procedures, frequency and type of tests.
   b. Specify cleaning procedures for all components.
3. As-Built Drawings: Provide three (3) full-size copies of all plans, drawings and schematics to the owner after the acceptance test. The drawings shall be revised to show equipment locations, location of all junction boxes, terminal cabinets, devices, wiring and conduit routings. Drawings, etc. shall be delivered as part of the O&M Manual package.

1.8 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: All system components shall be furnished by manufacturers of established reputation and experience who shall have produced currently operating Integrated Security Management Systems which include access control, alarm monitoring, CCTV video switching, paging, and video badging. Manufacturer shall be able to refer to similar installations rendering satisfactory service. Proposed equipment manufacturer must meet the following:
   1. All products designed and manufactured to ISO 9001 standards.
   2. Engaged in manufacturing of access control systems at least 10 years.
   3. System shall be of latest design. No obsolete or pending obsolete parts shall be used.
   4. Provide technical support to installer.
B. Installer Qualifications: Engage an experienced factory-authorized Installer to perform work of this Section.

1. Installing contractor must meet the following:
   a. Factory trained Honeywell WinPak Pro technicians to install the proposed system.
   b. The Installer must be certified by Honeywell Integrated Security Dealer Service Certification Program (DSCP).
   c. The installer shall be a Honeywell Commercial Security Systems (CSS) Dealer. Proof of compliance with manufacturer’s system installation certification program must be provided in writing to owner along with submittal.
   d. Company shall employ experienced installation and service Technicians that are certified to work with Network systems (minimum CompTIA Network+ Certified).
   e. Hold all legally required state and local contractor’s licenses necessary to accomplish the installation and activation of the described system. Copies of required licenses shall be submitted prior to start of work.
   f. Provide list of technical support staff, project experience, training, etc. as requested. Staff must be factory trained or have received on-site training from manufacturer.
   g. Make all final connections, adjustments and system supervision testing.
   h. Provide all initial system programming.

2. Provide references upon request:
   a. Names of (6) similar projects in size and scope.
   b. Contact person and phone number for each project.

C. Single source responsibility: The complete performance of the assembled system, including all accessories shall be the sole responsibility of the supplier. It is the installer’s responsibility to ensure that all factory and field installed accessories and loose components used in the system, meet these specifications, and perform up to the stated and tested standards.

D. Comply with the applicable building code, local ordinances, and regulations, and the requirements of the authorities having jurisdiction. Installation and operation shall conform to the latest applicable requirements of the following publications:

1. National Fire Protection Association (NFPA):
   a. NFPA 70 National Electrical Code
   b. NFPA 101 Code for Safety to Life from Fire in Buildings and Structures
2. Underwriters Laboratories (UL):
   a. UL 294, UL 1076, ULC
3. FCC – Part 15, Part 68

E. Certification of all system components:
   1. Catalogued by the system manufacturer.
   2. UL Listing of each component individually.
3. All components shall be recognized by the control system manufacturer for use and compatibility with proposed system.

1.9 SYSTEM PROGRAMMING

A. Database: The CONTRACTOR shall assist the OWNER in setting up the system database requirements and formats. Forms to be utilized in collecting and entering all data shall be provided to the OWNER by the CONTRACTOR. Written instructions on the use of all forms shall be included. Examples of the sequence of completion for all related forms shall be provided. The OWNER shall be responsible for the actual data collection and entry to ensure a complete understanding of the system and its contents.

B. Programming: The CONTRACTOR shall initially configure the system in accordance with the design shown in the drawings. All the access control requirements, alarm point definitions, alarm point call up and in/out relationships, individual component descriptions, and any other programmable parameters required shall be as shown in the appropriate drawings and schedules. The OWNER shall perform any additional programming with the assistance of the CONTRACTOR.

1.10 TRAINING

A. The CONTRACTOR shall supply personnel to create a cadre of key OWNER employees in the operation and maintenance of the installed system. A training program shall be designed to provide a comprehensive understanding and basic level of competence with the system. It shall be sufficiently detailed to allow OWNER personnel to operate the system independent of any outside assistance.

B. The training plan shall include detailed session outlines and related reference materials. The OWNER personnel shall be able to utilize these materials in the subsequent training of their co-workers.

C. Provide two sessions. Each training session shall be 2-hour and shall consist of system training and maintenance familiarization training. Contractor shall also provide a (2) hour follow-up training session shall be provided to customer within 60 days of initial training.

D. The specified training schedule shall be coordinated with the OWNER. Specific schedules shall be established at the convenience of the OWNER.

1.11 COORDINATION WITH OTHER TRADES

A. Coordinate access control system connections and equipment locations with other equipment, construction, and installers prior to ordering or installing any wiring, materials, etc.
   1. Electrical latch retraction push bars, door handsets, door strikes, releases, and hardware.
2. Fire Alarm systems.
3. Intrusion Detection system.
4. Door/frame installation.
5. Communication/Network Systems.

1.12 SUPERVISION OF WORK

A. The CONTRACTOR shall personally, or through an authorized and competent representative, constantly supervise the work from beginning to completion and shall, within reason, keep the same workmen and foreman on the project throughout the duration.

B. Site Project Manager: ordinate intrusion detection system connections and equipment locations with other equipment, construction, and installers prior to ordering or installing any wiring, materials, etc.
   1. The CONTRACTOR shall provide a Site Project Manager to interface with all appropriate subcontractors during the installation of the system.
   2. The Site Project Manager shall maintain continuing coordination with the CUSTOMER Project Coordinator, keeping him abreast of progress and informed on any problems that may develop. This is absolutely essential so that interference with daily facility operations is held to the minimum.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. No Substitutes. To insure system uniformity and compatibility with all other Washington County Public Schools Access systems, alternative equipment other than the exact make and model number identified in this specification will not be accepted.

B. All equipment shall be of the same design and manufacturer as existing access control systems currently in use by Washington County Public Schools. PROVIDE HONEYWELL PRO SERIES CONTROL PANELS/CARD READERS and related equipment as specified. Alternative manufacturers will not be compatible with the existing equipment and will not be accepted.

C. The quantities of components shall be determined and installed by the Contractor based on the requirement to provide a fully operational Integrated Security Management System (ISMS), as per the intent of the specification, and as shown on the drawings and recommended by the Manufacturer.

D. The system shall operate under OS 64-bit and 32-bit Microsoft Windows® Server 2008 R2 SP1, Microsoft Windows® 7 SP1 (64-bit), Windows Server 2012 R2, Windows 8.1 and Windows 10.
**E. Communication between satellite stations and the master file server station shall be in accordance with conventional Windows LAN/WAN operation using TCP/IP protocol.**

### 2.2 FRONT END SYSTEM

A. The master file server station, stand-alone stations, and workstations shall utilize compatible desktop (full-size) or Server computers (PCs). The requirements for the PC shall be scaled according to system application requirements. The work station shall be provided by the customer.

### 2.3 FRONT END SOFTWARE SPECIFICATIONS

A. The System software shall be HONEYWELL ACCESS SYSTEMS WIN-PAK PRO PE WPP45. The OWNER shall provide the server.

### 2.4 ACCESS CONTROL FIELD HARDWARE DEVICES

A. The security management system shall be equipped with access control field hardware required to receive alarms and administer all access granted/denied decisions. All field hardware shall meet UL requirements. The system shall include the following PRO3200 series components:

1. **Intelligent Controller shall be HONEYWELL ACCESS SYSTEMS PRO32IC.** A PRO32IC shall link the security management system software to all other field hardware components (card reader modules and input and output control modules). The PRO32IC shall provide full distributed processing of access control and alarm monitoring operations. Access levels, hardware configurations, and programmed alarm outputs assigned at the administration workstation shall be downloaded to the PRO32IC, which shall store the information and function using its high-speed, local 32-bit microprocessor. All access granted/denied decisions shall be made at the PRO32IC to provide fast responses to card reader transactions.

   a. Networking of PRO32IC: The system shall include a built-in network interface module. The interface shall be 10/100 Mbps Ethernet based and capable of residing on a local area network (LAN) or wide area network (WAN) without connectivity to a PC serial port. PRO32ICs with the network interface module shall be able to communicate with the database server through industry standard switches and routers.

   b. Offline Operation: In the event that the PRO32IC loses communication with system software, it shall continue to function normally (stand-alone). While in this offline state, the PRO32IC shall make access granted/denied decisions and maintain a log of the events that occur. Events shall be stored in local memory and uploaded to the system software after communications are restored.

   c. Features: The PRO32IC shall contain the following features:

      1) Communications: The following communication formats shall be supported:

         a. RS-232 at a speed of 38.4 Kbps
b) RS-485 at a speed of 38.4 Kbps.
c) Ethernet at 10/100Mbps (10/100BASE-T, RJ45)

2) Memory:
   a) Real time program updates, and overall host communications shall utilize flash memory.
   b) Can be configured for up to 50,000 cardholders and 35,000 event buffer.

3) Additional ports shall be provided for connecting card readers and data gathering panels via RS-485 multi-drop wiring configuration. Two (2) ports shall be available with up to 8 total boards connected in any combination.

4) Devices: Up to 8 devices consisting of reader interface modules, input modules, and output modules shall be supported. The devices shall be connected in any combination.

5) Processor: The PRO32IC shall contain a 32-bit processor.

6) Light emitting diodes (LED) shall indicate status of components and communication links.

7) Readers: The PRO32IC shall support the following:
   a) Up to eight card formats and facility codes.
   b) Multiple card technologies.
   c) Biometric interface support.
   d) Integration with other manufacturers’ card readers.
   e) Issue code support shall be provided for both magnetic and Wiegand card readers.
   f) Up to eight-digit PIN codes.

8) Electrical Power:
   a) Primary input power shall be 12VDC±15%@ 350 mA with an operating range of 10 VDC to 16VDC.
   b) The PRO32IC shall be equipped with an uninterruptible power supply (UPS) and backup battery.

2. Dual Reader Module shall be HONEYWELL ACCESS SYSTEMS PRO32R2: The PRO32R2 shall provide an interface between the PRO32IC and the card readers. The PRO32R2 shall operate with any card reader that produces a standard Wiegand (Data 1/Data 0) or Clock and Data communication output. A single PRO32IC shall be able to multi-drop up to sixteen (16) PRO32R2s. The following requirements shall also apply:
   a. Each PRO32R2 shall support two card readers, each of which may be up to 500 feet from the PRO32R2.
   b. Up to 16 PRO32R2s shall be connected to each PRO32IC.
   c. Each PRO32R2 shall include Three (3) relay inputs and two (2) relay outputs per reader. Two (2) additional inputs and two (2) additional outputs shall be available when the module is mounted flat.
   d. Up to eight (8) unique card formats shall be supported.
   e. The PRO32R2 shall support three access modes upon loss of communication with the PRO22IC. These modes shall be:
   f. Locked/Unlocked/Facility code
   g. Input power shall be 12VDC±15%@ 175 mA with an operating range of 10 VDC to 14VDC.
h. A PRO32R2 shall be provided to support integrated security system card readers for disarm functions. Provide a PRO22R2 for each security disarm station located on drawings. Connecting more than one reader per port will not be accepted.

3. INPUT MODULE PRO32IN: The PRO32IN monitors all system alarm inputs. The following requirements shall apply:
   a. The PRO32IN shall provide up to sixteen (16) supervised alarm inputs to monitor and report fault conditions, (open, short, ground, or circuit fault) alarm conditions, power faults, and tampers. Upon alarm activation, the associated alarm condition shall be reported to the PRO32IC and subsequently to the system alarm monitoring workstation.
   b. Light emitting diodes (LED) shall indicate the status of the sixteen (16) alarm zones, cabinet tamper, and power fault.
   c. The input modules shall operate independently and in conjunction with the output modules (PRO32OUT), which shall send an output signal to a corresponding output device upon alarm activation. Upon alarm activation, the PRO32IN shall activate any or all alarm outputs within the PRO32OUT. The PRO32OUT shall provide sixteen (16) Form C outputs rated at 2A @ 30VDC. Upon receipt of an alarm input from the PRO32IN, the PRO32OUT shall transmit an activating signal to a corresponding output device.
   d. Up to eight (8) PRO32INs shall be connected to an available PRO32IC via RS-485 cabling.
   e. Diagnostic light emitting diodes (LED) shall indicate PRO32IC communication, input zone scanning, and PRO32IN heartbeat.
   f. The PRO32IN contains the following features:
      1) Alarm contact status scanning at up to 180 times per second for each zone.
      2) Eight configuration DIP switches to assign unit addresses and communications speed.
      3) A low power CMOS microprocessor. Filtered data for noise rejection to prevent false alarms.
      4) Two form-C, 2A @ 30VDC contacts for load switching.
      5) Two dedicated inputs for tamper and power status.
      6) Individual shunt times (ADA requirement).
   g. Input power shall be 12VDC±15%@ 350 mA with an operating range of 10 VDC to 16VDC.

4. OUTPUT MODULE PRO32OUT: The PRO32OUT incorporates sixteen (16) output relays that are capable of controlling a corresponding output device upon any input activation or on command from the system.
   a. Output relays shall be capable of responding to:
      1) Input alarms from within the same PRO32IC.
      2) Commands from a system operator.
      3) Time zone control commands for automatic operation.
   b. Output relays shall be capable of:
      1) Pulsing for a predetermined duration, which shall be programmable for each relay individually.
1) Following any input point from a PRO32IN attached to the same PRO32IC (on with alarm, off when clear, or as required).

2) Responding on command from the system operator to pulse, command on, command off, or reset to normal state.

3) Each PRO32OUT shall provide 16 form-C relays rated at 2A @ 30VDC. The PRO32OUT shall control the relays via digital communication. Upon receipt of an input from the PRO32IN or command from the system operator, the PRO32IN will transmit an activating signal to the corresponding relay.

4) Input power shall be 12VDC±15%@ 350 mA with an operating range of 10 VDC to 16VDC.

5. Enclosure shall be HONEYWELL ACCESS SYSTEMS PRO22ENC1 wall mount enclosure.

6. Power supply shall be HONEYWELL ACCESS SYSTEMS PRO32E1PS.

7. Provide and install one (1) HONEYWELL ACCESS CONTROL PANELS to support access control and intrusion disarm readers.

2.5 ACCESS CONTROL READERS

A. Access control card readers shall be HONEYWELL ACCESS SYSTEMS OM40BHOND Contactless Smart Card Readers.

1. Provide single gang surface mounting style 13.56 MHz contactless smart card readers suitable for minimal space mounting configurations as shown on the project plans.

2. Provide manual bypass switch for each elevator

3. Provide HONEYWELL ACCESS SYSTEMS OM40BHOND Contactless Smart Card Readers for all locations shown on drawings.

2.6 INTRUSION DETECTION DISARM READERS

A. Intrusion detection arm/disarm readers shall be HONEYWELL ACCESS SYSTEMS OM40BHONC Contactless Smart Card Readers.

1. Provide single gang surface mounting style 13.56 MHz contactless smart card readers suitable for minimal space mounting configurations as shown on the project plans.

2. Provide one (1) OM40BHOND reader located beside each Honeywell 6160 security system keypad for integrated disarm functions. Readers shall be professionally labeled “DISARM”.

3. Provide (1) PRO32R2 module to support each disarm card reader.

a. The access system shall be integrated with the Honeywell Intrusion Detection System Access Control. Integration shall provide ability to arm/disarm intrusion system via card readers located beside each security keypad. Utilizing trigger and procedures programming, card holders shall either be granted or denied access to the building based on the armed status of the intrusion alarm system (via programming, selected card users may be restricted access to the building when the intrusion alarm system is armed).
b. Security/access system shall log arm/disarm events by user in event history log.
4. Provide (1) LANSRLU1 Ethernet Serial Converter for integration with Honeywell Access and CCTV systems.
5. Provide one (1) PRO32OUT relay for integration with Honeywell intrusion detection system

2.7 ACCESS CONTROL CARDS

A. Access control cards shall be HONEYWELL ACCESS SYSTEMS OKM2N34SP
   1. The card shall be capable of accepting a slot punch on one end, allowing it to be hung from a strap/clip in a vertical orientation.
   2. The card shall meet the following standards for contactless smart cards: ISO 15693 and ISO 14443B2.
   3. Facility code and card numbers shall be coordinated with owner.

2.8 SURGE PROTECTION

A. Access control panel surge suppressor shall be TRIPP-LITE IBAR12-20ULTRA.
B. Electronic door hardware surge/noise suppressors shall be HONEYWELL S-4 (2 per door).
C. Surge protection for electronic door hardware power supply shall be DITEK DTK-120HW (1 per power supply).

2.9 DOOR POSITION SENSORS

A. Door status sensors shall be installed for each controlled access door. Door sensors contacts shall be Door contacts shall be HONEYWELL 3/4” diameter wide gap.
B. Door lock status (latch bolt monitor built into electronic door hardware) sensors shall be supervised to monitor door lock status for each controlled access door.
C. A shunt lock shall be located at access control panel for manual bypass on/off control of door alarm sounders. A shunt lock shall be provided for each sounder. Shunt lock shall be HONEYWELL 4005 SERIES SHUNT LOCK with stainless steel face plate and back box.

2.10 ELEVATOR CARD READER INTEGRATION

A. Coordinate elevator access control system connections with elevator contractor. Provide a manual bypass switch for each access control relay output to allow manually bypassing of each card reader relay output to elevator control equipment. Bypass switches shall be installed on a cabinet in the elevator equipment room and shall be professional labeled and identified.
B. All final connections inside elevator control panel shall be performed by the elevator contractor.

2.11 ELECTRONIC DOOR EQUIPMENT

A. Coordinate access control system connections with electronic door hardware and power supplies supplied and installed by door hardware contractor. Provide necessary make/break connections at power supplies provided by door hardware contractor(s).

2.12 FLOOR PLAN GRAPHIC

A. Provide floor plan graphic to include all card reader locations. Owner to provide floor plans in WMF format.

B. Program to allow multiple floor plans to be viewed simultaneously.

2.13 INTEGRATED VIDEO INTERCOM ENTRY SYSTEM

A. Install an integrated Video Entry System in accordance with manufacturer’s instructions at locations indicated on the Drawings and Riser Diagrams.

B. The Video Entry System shall be the Aiphone Corporation “IS Series” integrated security and communication system.

C. The following Aiphone IS Series components shall be installed:
   1. One (1) AIPHONE IS-CCU Central Control Unit (rack mount)
   2. One (1) AIPHONE IS-PS-UL Power Supply
   3. One (1) AIPHONE IS-RACK power supply rack
   4. One (1) APC SMT1500RM2U Uninterrupted Power Supply
   5. One (2) AXIS M7014 Video Encoders (for NVR recording of CCU analog outputs)
   6. Four (4) HONEYWELL HUTP214TM Passive Transceivers (2 per CCU output)
   7. Three (3) AIPHONE IS-MV Master Stations
      a. Office Reception
      a. Office Reception
      b. Kitchen Office (programmed for independent operation)
   8. Two (2) AIPHONE IS-DVF Video Intercom Door Stations (flush mount)
      a. Main Entrance
      b. Receiving
   9. Two (2) AIPHONE SBX-IS-DVF Video Intercom Door Station Back Box
   10. (*) Integrate with access control system for release of controlled doors
   11. (*) Integrate with IP camera surveillance system for recording of analog video outputs
   12. (*) Necessary CAT-6 cable per manufacturer’s specifications
   13. (*) Installation in accordance with manufacturer’s requirements.
14. (*) Necessary programming for proper operation and in accordance with Owner’s requirements

2.14 ACCESS CONTROL PARTS INVENTORY

A. The CONTRACTOR shall maintain a stock of replacement parts sufficient to provide responsive same-day or next-day service with a minimum down time. Written verification of required inventory shall be provided prior to completion of installation.

B. CONTRACTOR to maintain an inventory of one (1) of each of the following critical components:
1. PRO32IC Intelligent Controller
2. PRO32IN Input Module
3. PRO32OUT Output Module
4. PRO32R2 Two Reader Module
5. PRO22DCC Daisy Chain Cable
6. PRO22BAT1 Operational Backup Battery
7. PRO32E1PS Power Supply
8. OM40BHOND Smart Card Reader
9. S-4 Suppresser Kit
10. LANSRLU1 Ethernet Serial Converter
11. IS-MV Master Station
12. IS-DVF Video Intercom Door Station

PART 3 EXECUTION

3.1 GENERAL INSTALLATION

A. Install, make fully operational, and test the access control system as indicated both on the drawings and in this specification. Where information is not available from the Owner upon request, the worst case condition must be assumed for bidding purposes to ensure a complete, functional system. Where appropriate, interfaces with the Customer’s Telecommunications System shall be coordinated with the Owner’s Representative.

B. Where appropriate, interfaces with the Customer’s Telecommunications System shall be coordinated with the Owner’s Representative.

C. All necessary back-boxes, pull-boxes, connectors, supports, conduit, cable, and wire shall be furnished and installed to provide a complete and reliable system. Exact location of all boxes, conduit, and wiring runs shall be confirmed with the OWEN or the owner’s representative.

D. Install conduit, cable, and wire parallel and square with building lines, including raised floor areas. Conduit fill shall not exceed forty (40) percent.
E. All equipment shall be rack-mounted with sufficient clearance to meet all applicable codes and facilitate observation and testing. All equipment shall be securely fastened with appropriate fittings to ensure positive grounding and be free of ground loops throughout the entire system. Units shall be installed parallel and square to building lines. All wires shall be gathered and fastened to create an orderly installation.

3.2 WIRE AND CABLE

A. After installation, and before termination, all wiring and cabling shall be checked and tested to ensure there are no grounds, opens, or shorts on any conductors or shields. A V.O.M. shall be utilized to accomplish these tests.

B. Visually inspect wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps except during actual termination.

C. All wiring shall be installed concealed above ceiling and in walls. Conductors shall be carefully cabled and laced. All exposed wiring below ceiling shall be installed in EMT conduit or metal raceway wiremold. Exposed wiring in public areas will not be accepted. All wiring shall be shielded. Use plenum cable.

D. All cable shall be as specified by the manufacturer: All access control cables shall be plenum rated with shield.
1. Card readers: 18-6 from card reader to access panel
2. Door status: 18-2 from door status sensor to access panel
3. Door locks: 14-2 from door lock to power supply to access panel
4. Panel integration: 18-6 between existing and new access control panels
5. Spare: 18-4 from each door power supply to access panel
6. Network connection: CAT-6 from access panel to network connection

E. Protect wire and cable from kinks. Provide grommets and strain relief material where necessary, to avoid abrasion of wire and excess tension on wire and cable.

F. All cables, wires, wiring forms, antennas, terminal blocks, and terminals shall be identified by labels, tags, or other permanent markings. The markings shall clearly indicate the function, source, and destination of all cabling, wiring and terminals. All cables and wires shall be identified, utilizing heat-shrunk, pre-printed, wire markers. Individual conductors shall be tagged with E-Z Code Markers indicating circuit number and type. Markers shall be used on all conductors at each outlet, pull box and termination points.

3.3 INSPECTIONS

A. Arrange all required inspections by the Authority Having Jurisdiction.
1. Notify all parties of Inspection and results.
2. Perform all adjustments, changes, etc. required.

3.4 START-UP RESPONSIBILITY
A. The Contractor shall properly ground each piece of electronic equipment prior to applying power. Properly ground all shielded wire shields to the appropriate earth ground at the hub end only, not at the remote or device end.

B. The Contractor shall initiate system operation. Competent start-up personnel shall be provided by the Contractor on each consecutive working day until the system is fully functional and ready to start the acceptance test phase.

C. Where appropriate, the Contractor shall bring the System online in its basic state. It is the responsibility of the Customer to provide the specific database information that will provide full, integrated system operation.

3.5 PREPARATION FOR ACCEPTANCE (Prior to Final Inspection)

A. Temporary facilities and utilities shall be properly disconnected, removed, and disposed of off-site.

B. All systems, equipment, and devices shall be in full and proper adjustment and operation, and properly labeled and identified.

C. All materials shall be neat, clean, and unmarred and parts securely attached.

D. All broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. shall be replaced or properly repaired, and debris cleaned up and discarded.

E. All extra materials as specified shall be delivered and stored at the premises as directed.

F. Test reports of each system and each system component, and As-Built project drawings shall be complete and available for inspection and delivery as directed by the Customer.

3.6 SYSTEM ACCEPTANCE REQUIREMENTS

A. Before final acceptance of work, the Contractor shall perform and/or deliver each of the following in the order stated:

1. Systems Operation and Maintenance Manuals. The Contractor shall deliver three (3) composite “Systems Operation and Maintenance” manuals in three ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:
   a. A Statement of Guarantee including date of termination and the name and phone number of the person to be called in the event of equipment failure.
b. A set of operational procedures for the overall system that includes all required Customer activities and that allows for Customer operation of all system capabilities. This procedure shall fully address all Customer established system operating objectives.

c. Individual factory issued manuals, containing all technical information on each piece of equipment installed. In the event such manuals cannot be obtained from a manufacturer, it shall be the responsibility of the Contractor to compile and include them. Advertising brochures or operational instructions shall not be used in lieu of the required technical manuals and information. All manuals shall be printed to ensure their permanence. No “blue line” type of reproduction is acceptable.

2. System testing.
   a. Activate all alarm or other output devices that are in the system for proper operation, including supervisory and trouble circuit tests.
   b. A checkout report for each piece of equipment shall be prepared by the CONTRACTOR and submitted to the OWNER, one copy of which shall be registered with the equipment manufacturers. This report shall include a complete listing of every device, the date it was tested and by whom, and the results and date tested (if failure occurred during any previous tests). The final test reports shall indicate that every device tested successfully. Submit two typed copies of the test reports on 8 ½” x 11” paper, in a neatly bound folder to the OWNER for approval. Failure to comply with this will result in a delay of final testing and acceptance.

3. As-Built Drawings. After completion of all the tests listed above, and prior to the Final Acceptance Test, the Contractor shall submit the complete As-Built drawings as identified in Project Record Drawings. These drawings shall include:
   a. As-Built conduit layout diagrams, including wire and cable tag designations.
   b. Complete As-Built wiring diagrams, including complete terminal strip layout and identification, and wire termination and tagging for all conductors.
   c. Locations for all major equipment components installed under this specification.

4. Final Acceptance Test.
   a. After the testing report and as-built drawings have been approved by the Customer’s representative, the completed system shall be tested in the presence of the Customer’s representative.
b. Acceptance of the system shall require a demonstration of the stability of the system. This shall be adequately demonstrated if the system operates for a ninety (30) day period with a 99% system on-line reliability. Should major equipment failure occur, the Contractor shall replace component(s). This test shall not start until the Customer has obtained beneficial use of the system. Once the final test is complete, each purchased spare component must be inserted into the System and the System tested in potentially affected areas again to insure complete functionality. The original removed parts will become the System spares.

5. Notice of Completion.
   a. When the Final Acceptance Test described above has been satisfactorily completed, the two (2) year guarantee period will start.

3.7 WARRANTY SERVICE

   A. Warrant the equipment and wiring free from electrical and mechanical defects for a period of two years from the date of Owner’s acceptance of system.

   B. Fully qualified repair and maintenance personnel shall be available on a twenty-four (24) hour a day basis, three hundred and sixty-five (365) days a year, with four (4) hour maximum response time for service.

   C. Normal service shall be defined as minor repairs and/or adjustments. Service of this nature shall be provided at no cost to the Customer during normal business hours, which are between 8:00AM and 5:00PM, Monday through Friday. For service calls requested by phone before 11:00 AM on a weekday, service shall occur on a same-day basis.

   D. Emergency service shall be required for emergencies defined as critical equipment not being functional, and shall be furnished at no cost to the Customer during the warranty period. Emergency service shall respond within a four (4) hour period, twenty-four (24) hours per day, three hundred and sixty-five (365) days a year. A list of critical equipment shall be developed and coordinated by the Customer and the Contractor.

END OF SECTION
PART 1 GENERAL

1.1 SCOPE AND RELATED DOCUMENTS

A. The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials, and performance of all operations in connection with the installation of additional devices to the existing Fire Alarm System.

B. The requirements of the conditions of the Contract, Supplementary Conditions and General Requirements apply to the work specified in this section.

C. The complete installation is to conform to the applicable sections of NFPA-72, Local Code Requirements and the National Electrical Code with particular attention to Article 760.

D. The work covered by this section of the specifications is to be coordinated with the related work as specified elsewhere under the project specifications.

1.2 QUALITY ASSURANCE

A. Each and all items of the Fire Alarm System shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the "UL." label. All control equipment is to be listed under UL category UOJZ as a single control unit. Partial listing shall NOT be acceptable.

B. The equipment and technical supervision furnished under this specification is to be provided directly by the equipment manufacturer. The manufacturers' project representative shall be NICET LEVEL IV Certified (Senior Engineering Technician) in the field of fire alarm system technology. A copy of the representative’s certificate shall be included with the equipment submittals.

C. All control equipment must have transient protection devices to comply with UL864 requirements.

1.3 GENERAL

A. Furnish and install additional devices to the existing Siemens Fire Alarm System as described herein and as shown on the plans; to be wired, connected, and left in first class operating condition.
B. The system shall use analog addressable initiating device circuits with individual device supervision, individual notification appliance circuit supervision, incoming and standby power supervision. Include power supplies, manual pull stations, horns, strobes, wiring, connections to devices, outlet boxes, junction boxes, and all other necessary material for a complete operating system.

1.4 SUBMITTALS

A. Include bound equipment data booklets to include the following:
   1. An indexed list of materials with mounting box requirements for each device. Each item shall reference a page number where detailed manufacturers data for that component can be located within the submittal.
      a. Product data for system components shall include UL listing information, detailed product data, dimensioned plans and elevations showing minimum clearances and installed features of devices.
      b. Where more than one product model is described on the manufacturers data sheet, the specific unit proposed shall be highlighted or otherwise identified.
   2. When equipment other than that specified is submitted, a complete paragraph-by-paragraph comparison with the specification shall be included.
   3. A detailed battery calculation document indicating each control panel component and peripheral device along with the following information:
      a. The quantity of each component
      b. The stand-by and alarm power requirements of each component
      c. Calculations to clearly indicate battery size needed to comply with the specification requirements.
      d. The size of batteries that are proposed to be furnished.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. All fire alarm system conductors shall be installed in conduit. Wire sizes and types shall be per manufacturer recommendations.

B. Install system according to NFPA Standards referenced in Parts 1 and 2 of this Section.

C. Fire Alarm Power Supply Disconnect: Paint red and label "FIRE ALARM." Provide with lockable handle or cover.

3.2 EQUIPMENT INSTALLATION
A. Existing Fire Alarm Equipment (If Applicable): Maintain fully operational system. As new equipment is installed, label it "NOT IN SERVICE" until operational. Remove tags from new equipment when put into service and tag existing fire alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal (If Applicable): After acceptance of the new fire alarm system, remove existing, disconnected fire alarm equipment and restore damaged surfaces. Remove from the site and legally dispose of the material.

C. Manual Pull Stations: Mount semi-flush in recessed back boxes with operating handles 42 inches above finished floor or as indicated. The existing pre-alarm security covers shall be reused for the new fire alarm system manual pull stations.

D. Audible Alarm-Indicating Devices: Install not less than 80 inches above the finished floor nor less than 6 inches (160 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille or as indicated. Combine audible and visual alarms at the same location into a single unit.

E. Visual Alarm-Indicating Devices: Install at 80 inches (2000 mm) above the finished floor or 6 inches (150 mm) below the ceiling, whichever is lower.

3.3 WIRING INSTALLATION

A. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceways." Conceal raceway except in unfinished spaces and as indicated.

B. Wiring Within Enclosures: Install conductors parallel with or at right angles to the sides and back of the enclosure. Bundle, lace, and train the conductors to terminal points with no excess. Mark each terminal according to the wiring diagrams of the system. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

C. System Wiring: For the low-voltage portion of the fire alarm system, install No. 14 AWG conductors and 75-deg C insulation in wet, damp, or dry locations. For line-voltage wiring, install No. 12 AWG size with insulation rated 75 deg C minimum.

D. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm circuits wiring and a different color code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visual alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

E. Wiring to Central Station Transmitter: 1-inch (Size 27) conduit between the FACP and the central station transmitter connection as indicated. Install number of conductors and electrical supervision for connecting wiring as required to suit central-station monitoring function.
3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a factory-employed service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.

B. Pretesting: Upon completing installation of the system, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

C. Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of the witnesses to the preliminary tests.

D. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.

E. Minimum System Tests: Test the system according to the procedures outlined in NFPA 72H, Chapters 2 and 4, and NFPA 72E, Chapter 8. Minimum required tests are as follows:
   1. Verify the absence of unwanted voltages between circuit conductors and ground.
   2. Megger test all conductors other than those intentionally and permanently grounded with electronic components disconnected. Test for resistance to ground. Report readings less than 1-megohm for evaluation.
   3. Test all conductors for short circuits utilizing an insulation-testing device.
   4. Verify the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.
   5. Test each initiating and indicating device for alarm operation and proper response at the control unit.
   6. Test the system for all specified functions according to the manufacturer's operating and maintenance manual. Systematically initiate specified functional performance items at each station including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications.

F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.
G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log upon the satisfactory completion of tests.

3.5 CLEANING AND ADJUSTING

A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.6 DEMONSTRATION

A. Provide the services of a factory-employed service representative to demonstrate the system and train Owner's maintenance personnel as specified below.
   1. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 4 hours' training.
   2. Schedule training with the Owner at least seven days in advance.

3.7 WARRANTY

A. The contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of the completed and certified test.

B. The equipment manufacturer shall make available to the owner a maintenance contract proposal to provide a minimum of two (2) inspections and tests per year in compliance with NFPA-72H guidelines.

END OF SECTION