

**SPECIFICATION
FOR:**



**ROOMS TO GO
Phase II Expansion
Dunn, North Carolina**

Owner:

ROOMS TO GO DISTRIBUTION COMPANY LLC
4000 Summit Blvd.,
Suite 600
Atlanta, Georgia 30319

Architect:

 **HAGERSMITH**
300 S. Dawson St.
Raleigh, NC 27601

Bid Set
Date: February 2, 2024

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BIDDING INFORMATION

1.1 REFERENCES AND DEFINITIONS

- A. Throughout the Drawings, Specifications, Addenda, and other Contract Documents, the term “Contractor” shall be taken to mean the General Contractor and/or his Subcontractors as defined in the Owner-Contractor Agreement. The Contractor’s Subcontractors will be defined by the term “Subcontractor(s).”
- B. The term “Owner” or “Owner’s Representative” shall be taken to mean the person or persons authorized by the Owner, Rooms To Go Distribution Company LLC, to act in his behalf.
- C. The Drawings and Specifications are complementary each to the other and what is called for by one shall be as binding as if called for by both. However, the Drawings and Specifications shall be considered inseparable documents and the Contractor shall consider both instruments in order to perform the Work in accordance with their combined intent.
- D. References to the “Architect” or “Engineer” in the Specifications or on the Drawings shall be taken to mean an authorized professional representative of the Owner including the Owner’s Representative.
- E. In case of discrepancies in the Contract Documents, the Contractor shall first consult with the Architect or the Owner for clarifications, revisions, or further action as may be required. Any discrepancy that results in any claim for additional time or money must be addressed to the Owner in writing.

1.2 DRAWINGS AND SPECIFICATIONS

- A. Each Bidder will be furnished one (1) complete set of the Bid Drawings and one (1) copy of Bid Specifications.
 - 1. It shall be the responsibility of each Bidder to obtain and pay for all copies of Drawings and Specifications that he may require to prepare his bid, and in the case of the successful Bidder, to perform the Work including Addenda and Change Bulletins.
 - 2. The bid set shall be retained for use as construction documents. Revisions shall be issued via Bid Addendum or Change Bulletin.

1.3 EXAMINATION OF CONTRACT DOCUMENTS

- A. Before submitting a proposal, each Bidder shall carefully examine all Drawings, Specifications, Addenda, and all other Contract Documents.
- B. All inquiries regarding the meaning of Drawings, Specifications, and/or other Contract Documents shall be addressed to the Professional of Record (HAGERSMITH DESIGN) as indicated on the Drawings. Bidders shall also note the following:
 - 1. Inquiries shall be limited to calls from pre-qualified Contractors bidding this Project. Subcontractors shall make contacts only through one of these Contractors.
 - 2. Bidders shall NOT rely on verbal replies. Should clarifications or revisions be required, the Bidding Documents will be modified by written Addendum distributed to all Bidding Contractors.
 - 3. NO pre-approvals will be given for substitute materials, equipment, or methods. Refer elsewhere in this Section for substitution procedures.
 - 4. Bidders are hereby instructed to qualify their respective bids in writing for all conditions not clarified by the Bidding Documents to their satisfaction. Any such qualifications MUST be submitted in writing with the Bid Proposal.

1.4 SITE INSPECTION

- A. Each Bidder shall visit the Project site prior to the preparation of his bid to investigate and determine all conditions, including access, property boundaries, and neighboring parcels, on and near the site that could affect the execution of the Work. Any Contractor's failure to fully acquaint himself with existing conditions under which the Work is to be performed will not be justification for additional compensation.
- B. The location of the underground utilities, such as sewers, electrical power, water piping, natural gas, telephone/communication, conduits, etc., indicated on the Drawings is as exact as can be determined from available information but its accuracy or completeness cannot be guaranteed. Exact location of these utilities shall be verified by the Contractor prior to starting work. Contractor shall exercise special care when excavating at or near the general location of underground utilities for the safety of workers, as well as for protection of the utility services.

- C. Any connections to or relocation of any existing utility line requiring temporary discontinuation of utilities that are in active use shall be scheduled and coordinated with the utility companies and/or the representatives of the Owner. All premium time required for the installation of any such connections and/or relocations shall be included in the Contractor's bid. In no case shall the utilities be left disconnected at the end of a working day or weekend unless authorized by representatives of the utilities and the Owner. Any existing utilities damaged due to the operation of the Contractor shall be repaired to the satisfaction of the Owner and utility company or agency, by the Contractor at no increase in the Contract cost.

1.5 INSURANCE

- A. The Contractor shall provide and maintain during the life of the Contract, insurance with insurers satisfactory to the Owner. Coverages noted below shall be provided. Any Contractor not having these limits shall so state in his proposal, otherwise it will be assumed the noted coverages are to be provided
1. Workmen's Compensation and Employer's Liability: Workmen's Compensation as required by statute and, if such exposures exist, Contractor's liability under the Federal Longshoremen and Harbor Workers Act. Employer's liability shall be for a minimum limit of \$1,000,000. In case any work is sublet, the Contractor shall require any and all of his Subcontractors similarly to provide such coverages for all the latter's employees employed in connection with the work, unless such employees are covered by the protection of the Contractor. Provide similar coverage for any class of employees engaged in work at the site who are not protected under the applicable workers' compensation statute.
 2. Comprehensive General Liability Insurance indemnifying and holding harmless the Property Owner and Rooms To Go, as additional insured, including contractual liability coverage, in an amount not less than \$5,000,000 for personal and bodily injury to all persons in any one occurrence and for damage to property; and;
 3. Motor Vehicle Liability Coverage, with coverage limits not less than \$1,000,000.

4. Certificates of insurance, satisfactory to Owner and naming Owner as a certificate holder and as an additional insured, shall be delivered to Owner prior to the commencement of work, and said certificates shall contain a provision that coverages afforded under the policies will not be canceled without thirty (30) days prior written notice to Owner. All insurance required to be carried by Contractor pursuant hereto shall be taken out with insurance companies approved by Owner in advance.
5. Builder's Risk Insurance: The Owner shall maintain a policy for the duration of the Project upon all structures and upon all materials in or adjacent thereto that are to be made a part of the insured structure to the insurable value thereof less a deductible amount of \$5,000.00 (Contractor paid) for each occurrence. This coverage will not include Contractor's and Subcontractor's equipment, and may not necessarily be all-inclusive as to Contractor's desired protection.
6. Owner's Protective Liability Insurance in the full amount of the Contract.
7. Umbrella Insurance: The Contractor shall carry an additional comprehensive umbrella policy to provide the exact same coverages as provided for comprehensive general liability, workmen's compensation and employer's liability, and motor vehicle liability coverage for a minimum \$5,000,000 limit of liability.

1.6 SPECIFIED MANUFACTURERS, SUBSTITUTIONS, AND ALTERNATES

- A. The following provisions shall govern the bidding of the Work. The provisions specified below shall not relieve the Contractor from meeting other requirements set forth elsewhere in the Bidding or Contract Documents.
- B. When a brand name is not specified:
 1. Product used shall meet the specified standard, such as ASTM, etc., if specified, and shall be of the appropriate design, configuration, type, and finish as required to meet the requirements of the intended service.
- C. When two (2) or more brand names are specified without further qualifying stipulations:
 1. Any one of the specified brands or manufacturer's products equivalent to the first-named may be used for the base bid price.

2. Should other than the first-named brand be used in preparation of the bid, the Contractor shall be responsible to determine and assure that the product or equipment being bid will fit and function in the space allocated.
 3. In all cases, the product used shall meet the requirements of the intended service, including specified optional accessories, performance, and basic features. Should one of the named manufacturers offer a range of quality for a particular item, the Contractor shall provide the selection of equal or greater quality compared with the first-named brand in the Specifications. All equality determinations rest with the Owner or Architect, and his decisions shall be final.
- D. When one (1) brand name only is specified without further qualifying stipulations:
1. Contractor's base bid price shall be based on the product specified.
 2. The Contractors are invited and encouraged to propose, as substitutions, the products or equipment of other manufacturers potentially suitable for the intended services and/or applications. See paragraph below regarding substitutions for further requirements.
- E. Substitutions:
1. Any material, product, or equipment (other than specified materials, brands, or manufacturers) proposed by the Contractor shall be considered a substitution.
 2. Except as otherwise specified herein below, in order to qualify for review by the Owner or Architect for a decision on approval, a substitution shall be submitted at the time of bidding. The proposed substitution shall be clearly identified and shall include the respective add or deduct to the Contract base bid amount as defined above. The Contractor shall submit complete amount as defined above. The Contractor shall submit complete data (including samples) regarding the substitution to the Owner or Architect for review and decision.
- F. Alternates:
1. When requested in the Specifications or on the Drawings, or by the Owner, Contractor shall include the total appropriate add or deduct, including all associated charges to the Contract amount for the Alternate as specified.

2. Requested Alternates shall be numbered and shall be clearly identified in the Contractor's bid.
3. Omission of requested alternate or unit pricing may invalidate the proposal.
4. Each bidder is encouraged to submit any voluntary alternates or unit prices he feels appropriate.
5. Alternate prices shall cover all labor, material, and related fees to perform the required work items. No additional adjustment will be allowed for overhead, profit, insurance or other direct or indirect expense of the Contractor or Subcontractor.

G. Unit Prices:

1. When requested in the Specifications or by the Owner, the proposal shall include unit prices for certain classes of work, to be used as the basis of payment to the Contractor.
2. Unit prices shall cover all labor, material and related fees to perform the required work items. No additional adjustment will be allowed for overhead, profit, insurance or other direct or indirect expense of the Contractor or Subcontractor.
3. Omission of unit pricing may invalidate the proposal.

H. Associated Costs and Delays:

1. All additional costs associated with the use of any product, material, or equipment (other than the first-named brand, a specified material, or a requested Alternate) shall be the responsibility of the Contractor making the substitution or electing to use other than the first-named brand.
2. For example, if a Contractor elects to use the third-named brand in the Specifications covering a particular item of equipment, and the choice of that brand necessitates an increase in electrical feeder size, additional structural support, access panels, or any other changes whatsoever in this work and/or the work of others, the Contractor shall include in his bid the cost of all such changes.
3. The approval of a substitution and/or the discovery of associated costs during construction shall not relieve the Contractor from paying for changes in his work and/or the work of others.
4. To avoid the associated costs as described above due to an untimely discovery of necessary changes, the Contractor may be permitted to revert to the use of the specified product, material, or equipment provided a delay in the Project does not result. The Owner shall first be consulted and his decision regarding the interpretation of "delay" shall be final.

5. It shall be further understood that the use of any approved substitution other than the first-named brand in the Specifications shall involve no extension of the Project completion date and/or shall not cause delays in the work of other contractors unless stipulated in writing with the respective Contractor's bid and/or proposal for substitution.

1.7 PROPOSALS

- A. Proposals shall be received by the Owner to the Attention of Mr. Harmon Jones no later than the time and date as designated in the "Invitation to Bid."
- B. Proposals shall be submitted on the enclosed "Proposal Form" sealed in an opaque envelope marked "Proposal." Proposals will not be accepted over the telephone. No exceptions to procedure will be allowed and any bid received after the specified time will be subject to rejection. To be considered a valid bid, proposals must be filled in completely including category breakdowns and qualification data.
- C. All proposals shall be in accordance with all requirements of all Contract Documents and subject to all conditions provided in same.
- D. All proposals shall be in a lump sum and shall cover and include all materials, accessories, tools, equipment, expendable equipment, insurance, taxes, overhead, profit and performance of all services and labor required to completely execute the work in accordance with the Contract Documents.
- E. Each bidder shall break his proposal into the categories per Page 5 thru 8 of the enclosed Proposal Form. This categorization is requested only to further clarify bids as well as assure understanding of the scope of work. These categories will not be considered as fixing the basis for any Contract adjustments. Additional cost breakdown within a category is acceptable.

END OF SECTION 00011

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SECTION 00015
LIST OF DRAWINGS

DRAWING NO.	TITLE	REVISION NO.	LATEST DATE/REVISION DATE	ISSUE TYPE
CIVIL DRAWINGS				
SITE 001	COVER SHEET	1	1/18/2024	Bid Doc.
SITE 100	EXISTING CONDITIONS PLAN	1	1/18/2024	Bid Doc.
SITE 101	DEMOLITION PLAN SOUTH	1	1/18/2024	Bid Doc.
SITE 102	DEMOLITION PLAN NORTH	1	1/18/2024	Bid Doc.
SITE 200	OVERALL SITE LAYOUT PLAN	1	1/18/2024	Bid Doc.
SITE 201	SITE LAYOUT & STAKING PLAN SOUTH	1	1/18/2024	Bid Doc.
SITE 202	SITE LAYOUT & STAKING PLAN NORTH	1	1/18/2024	Bid Doc.
SITE 300	OVER GRADING PLAN	1	1/18/2024	Bid Doc.
SITE 301	GRADING PLAN SOUTH	1	1/18/2024	Bid Doc.
SITE 302	GRADING PLAN NORTH	1	1/18/2024	Bid Doc.
SITE 303	INITIAL EROSION CONTROL PLAN	1	1/18/2024	Bid Doc.
SITE 304	FINAL EROSION CONTROL PLAN	1	1/18/2024	Bid Doc.
SITE 305	NPDES PLAN	1	1/18/2024	Bid Doc.
SITE 306	STORM PLAN & PROFILE	1	1/18/2024	Bid Doc.
SITE 307	STORM PLAN & PROFILE	1	1/18/2024	Bid Doc.
SITE 400	OVERALL UTILITY PLAN	1	1/18/2024	Bid Doc.

SITE 401	UTILITY PLAN SOUTH	1	1/18/2024	Bid Doc.
SITE 402	UTILITY PLAN NORTH	1	1/18/2024	Bid Doc.
SITE 500	OVERALL LANDSCAPE PLAN	1	1/18/2024	Bid Doc.
SITE 501	LANDSCAPE PLAN SOUTH	1	1/18/2024	Bid Doc.
SITE 502	LANDSCAPE PLAN NORTH	1	1/18/2024	Bid Doc.
SITE 600	SITE DETAILS	1	1/18/2024	Bid Doc.
SITE 601	SITE DETAILS	1	1/18/2024	Bid Doc.
SITE 602	SITE DETAILS	1	1/18/2024	Bid Doc.
SITE 603	SITE DETAILS	1	1/18/2024	Bid Doc.

ARCHITECTURAL GENERAL DRAWINGS

G-001	APPENDIX B		12/18/2023	Bid Doc.
G-101	LEVEL 1 LIFE SAFETY PLAN	1	2/2/2024	Rev.1

STRUCTURAL DRAWINGS

S-001	GENERAL NOTES, INDEX		12/18/2023	Bid Doc.
S-002	GENERAL NOTES		12/18/2023	Bid Doc.
S-003	ABBREVIATIONS, SYMBOLS & LAP LENGTH SCHEDULES		12/18/2023	Bid Doc.
S-004	ISOMETRIC VIEWS		12/18/2023	Bid Doc.
S-101A	FOUNDATION PLAN – AREA A		12/18/2023	Bid Doc.
S-101B	FOUNDATION PLAN – AREA B		12/18/2023	Bid Doc.
S-201A	ROOF FRAMING PLAN – AREA A		12/18/2023	Bid Doc.
S-201B	ROOF FRAMING PLAN – AREA B		12/18/2023	Bid Doc.

S-202	BATHROOM FOUNDATION AND FRAMING PLAN		12/18/2023	Bid Doc.
S-301	TYPICAL FOUNDATION DETAILS	1	2/2/2024	Rev. 1
S-302	TYPICAL FOUNDATION DETAILS	1	2/2/2024	Rev. 1
S-303	PANEL NUMBERING PLAN		12/18/2023	Bid Doc.
S-401	TILT-UP WALL ELEVATIONS		12/18/2023	Bid Doc.
S-402	TILT-UP WALL ELEVATIONS		12/18/2023	Bid Doc.
S-501	TILT-UP WALL ELEVATIONS		12/18/2023	Bid Doc.
S-502	TILT-UP WALL ELEVATIONS		12/18/2023	Bid Doc.
S-503	TILT-UP WALL ELEVATIONS		12/18/2023	Bid Doc.
S-504	TILT-UP WALL ELEVATIONS		12/18/2023	Bid Doc.
S-505	TILT-UP WALL ELEVATIONS		12/18/2023	Bid Doc.
S-506	TILT-UP PANEL REINFORCING ELEVATIONS		12/18/2023	Bid Doc.
S-601	TILT UP WALL DETAILS		12/18/2023	Bid Doc.

ARCHITECTURAL DRAWINGS

D-101	DEMOLITION PLAN, ELEVATION, AND DETAILS		12/18/2023	Bid Doc.
A-101	PHASE II EXPANSION FLOOR PLAN	1	2/2/2024	Rev.1
A-102	ROOF PLAN	1	2/2/2024	Rev. 1
A-201	EXTERIOR ELEVATIONS	1	2/2/2024	Rev. 1
A-202	ENLARGED EXTERIOR ELEVATIONS	1	2/2/2024	Rev. 1

A-301	BUILDING SECTIONS	1	2/2/2024	Rev. 1
A-302	EXTERIOR WALL SECTIONS	1	2/2/2024	Rev. 1
A-401	ENLARGED PLANS AND ELEVATIONS	1	2/2/2024	Rev. 1
A-402	INTERIOR ELEVATIONS AND SECTIONS		12/18/2023	Bid Doc.
A-501	DETAILS		12/18/2023	Bid Doc.
A-601	DOOR & WINDOW SCHEDULE	1	2/2/2024	Rev.1
AF-101	PHASE II EXPANSION FINISH FLOOR PLAN		12/18/2023	Bid Doc.

PLUMBING DRAWINGS

P-001	PLUMBING GENERAL		12/18/2023	Bid Doc.
P-101	OVERALL PLUMBING PLANS		12/18/2023	Bid Doc.
P-401	ENLARGED PLUMBING PLANS		12/18/2023	Bid Doc.
P-601	PLUMBING SCHEDULES		12/18/2023	Bid Doc.

MECHANICAL DRAWINGS

M-101	PLAN NORTH – MECHANICAL		12/18/2023	Bid Doc.
M-102	PLAN SOUTH – MECHANICAL		12/18/2023	Bid Doc.
M-501	MECHANICAL DETAILS		12/18/2023	Bid Doc.
M-502	NATURAL GAS RISER		12/18/2023	Bid Doc.
M-503	NATURAL GAS GENSET CONNECTION DETAIL		12/18/2023	Bid Doc.
M-504	WIND/SEISMIC CLIP DETAIL		12/18/2023	Bid Doc.
M-601	MECHANICAL SCHEUDLES		12/18/2023	Bid Doc.

ELECTRICAL DRAWINGS

E-001	ELECTRICAL GENERAL	1	2/2/2024	Rev. 1
E-002	ELECTRICAL DETAILS	1	2/2/2024	Rev. 1
E-101	PARTIAL FLOOR PLAN NORTH – POWER	1	2/2/2024	Rev. 1
E-102	PARTIAL FLOOR PLAN SOUTH – POWER	1	2/2/2024	Rev. 1
E-201	PARTIAL FLOOR PLAN NORTH – LTS	1	2/2/2024	Rev. 1
E-202	PARTIAL FLOOR PLAN SOUTH – LTS	1	2/2/2024	Rev. 1
E-501	ELECTRICAL RISER	1	2/2/2024	Rev. 1
E-601	PANEL SCHEDULE	1	2/2/2024	Rev. 1
ED-100	PARTIAL FLOOR PLAN – DEMOLITION – ELECTRICAL		12/18/2023	Bid Doc.
SL-01	SITE LIGHTING PLAN – LTS		12/18/2023	Bid Doc.
SL-02	SITE LIGHTING PLAN - POWER	1	2/2/2024	Rev. 1

FIRE ALARM

FA-001	FIRE ALARM GENERAL		12/18/2023	Bid Doc.
FA-101	PARTIAL FLOOR PLAN NORTH – FIRE ALARM		12/18/2023	Bid Doc.
FA-102	PARTIAL FLOOR PLAN SOUTH – FIRE ALARM		12/18/2023	Bid Doc.

FIRE PROTECTION

F-001	FIRE SPRINKLER COVER	11/28/2023	Bid Doc.
F-101	OVERALL FIRE SPRINKLER PLAN	11/28/2023	Bid Doc.
F-202	FIRE SPRINKLER DETAILS	11/28/2023	Bid Doc.

SECTION 00100

INSTRUCTIONS TO BIDDERS

1.0 DEFINITIONS

- 1.1 Definitions in AIA Document A201 "General Conditions of the Contract for Construction," 2017 Edition, apply to this Section.
- 1.2 Bidding Documents include Instructions to Bidders, the Bid Proposal Form, and the proposed Contract Documents, including any Addenda issued prior to receipt of bids. The Instructions to Bidders and the Bid Proposal Form will not become part of the Contract Documents.
- 1.3 Addenda are written or graphic instruments issued prior to execution of the Owner-Contractor Agreement to clarify, revise, add to, or delete information in original Bidding Documents or previous Addenda. Addenda will become part of the Contract Documents when the Agreement is executed.

2.0 EXAMINATION OF CONDITIONS AND DOCUMENTS

- 2.1 The Bidder is responsible for visiting and examining the site conditions and reviewing the Bidding Documents.
- 2.2 If Bidder is unclear as to the true meaning of the Bidding Documents, then Bidder must submit a written request to the Owner's Representative for an interpretation as stipulated elsewhere in these Instructions to Bidders. No additional costs will be allowed by Bidder's failure to thoroughly examine site conditions and review Bidding Documents.

3.0 PREBID CONFERENCE

- 3.1 A Prebid Conference will be held for this Project on a date and place to be determined.

4.0 QUALIFICATIONS OF BIDDERS

- 4.1 Any invited and prequalified Bidder may submit a Bid provided:
 - 4.1.1 Bidder can provide documented evidence of financial responsibility.

- 4.1.2 Bidder can secure a bond for the full value of the Project from a reputable bonding source licensed in the State of North Carolina.
- 4.1.3 Bidder has a documented record of successful and timely completion of projects similar to the scope and complexity of this Project.
- 4.1.4 Bidder has a qualified staff and is properly equipped to perform the work.
- 4.2 Each Bidder, and Bidder's proposed Subcontractors, Sub-Subcontractors, and lower tiers of Sub-Subcontractors shall be properly licensed under the federal, state, and municipal laws governing each respective trade in the area in which the Project is located.
- 4.3 If Bidder believes there may be a question concerning Bidder's qualifications, Bidder may ask for an opinion from the Owner's Representative at any time prior to submitting a Bid.
- 4.4 Before awarding a Contract, the Owner may require the apparent low bidder to furnish the following:
 - 4.4.1 A financial statement showing Bidder's assets and liabilities, current within 10 days of the bid opening, or other financial information satisfactory to the Owner.
 - 4.4.2 The name and home office address of the Surety proposed and the name and address of the responsible local claim agent.

5.0 ADDENDA

- 1.1 Changes to the Bidding Documents will be in the form of written Addenda issued by the Architect to all invited Bidders.
- 1.2 Bidder will be solely responsible for determining receipt of all Addenda.
- 1.3 Bidder may submit a written request to the Owner's Representative for interpretations as to the true meaning of any of the Bidding Documents, provided that such request is submitted not later than seven (7) calendar days prior to the date set for receipt of bids.

- 1.4 No information in oral, telephonic, or telegraphic form shall be binding unless affirmed by Addendum.

6.0 PREPARATION OF BID

- 6.1 Bids shall include sales, use, and all other applicable taxes.
- 6.2 All blank spaces on the Bid Proposal Form shall be completely filled in. Bid prices shall be typed or printed in both words and figures. In case of conflict between words and figures, the words, unless obviously incorrect, shall govern.
- 6.3 All signatures shall be in ink and the name of the persons signing shall also be typed or printed below the signature.
- 6.4 Any alteration of the Bid Proposal Form will be grounds for rejection of the submitted Bid.

7.0 BID BOND

- 7.1 A Bid Bond will not be required for this Project.

8.0 SUBMISSION OF BIDS

- 8.1 Each bid shall be submitted via email to pparks@RoomsToGo.com.
- 8.2 Bids may be mailed to Rooms To Go to the Attention of Mr. Harmon Jones. Bids may also be hand delivered at this address. Regardless of manner of delivery, any Bid received after bid time may not be accepted. The Bidder alone is solely responsible for timely delivery of bid.

9.0 WITHDRAWAL AND MODIFICATION OF BID

- 9.1 Bids may be withdrawn on personal, written, or telegraphic requests received from bidders prior to bid time. Withdrawn bids may be resubmitted up to bid time. Negligence or error on the part of the bidder in preparing his bid confers no right for withdrawal of the bid after it has been received. No bid may be withdrawn for 30 consecutive calendar days after bid time.

- 9.2 Modifications in writing or by telegraph for bids already submitted will be considered if received prior to bid time, but will not be considered after. Failure of the bid modification to be delivered on time will not confer on the bidder the right to modify it or withdraw it later.

10.0 OPENING OF BIDS

- 10.1 Bids will be opened and reviewed privately.

11.0 REJECTION OF BIDS

- 11.1 The Owner reserves the right to reject any and all bids and to waive any and all technical defects in the execution of, and information in, the submission of any bid.

12.0 AWARDING OF CONTRACT

- 12.1 The successful bidder will be required to sign a Contract with the Owner on a modified AIA Document A101 "Standard Form of Agreement Between Owner and Contractor", 2017 edition.

13.0 SUBMISSION OF POST-BID INFORMATION

- 13.1 Upon request by the Owner's Representative, the selected bidder shall within 7 consecutive calendar days thereafter submit the following:
- 13.1.1 Statement of items of work performed by Bidder's own forces, and by Bidder's Subcontractors.
 - 13.1.2 A list of Subcontractors names for the principal portions of the work for Owner review for acceptability. Prior to the award of the Contract, the Owner's Representative will notify the bidder in writing of any Subcontractors then rejected by the Owner. Subcontractors accepted by the Owner shall be used on the work for which they were proposed and accepted and shall not be changed except with the written notification by the Owner's Representative of the Owner's approval.

- 13.1.3 Notarized certification that the Contractor is capable of bonding the project for the full contract amount. The certification shall attest that the bonding company is currently licensed to provide the required bond instruments in the State of North Carolina and shall include the bonding company's current rating.
- 13.1.4 A Preliminary Bar Chart Schedule outlining the critical dates such as: notice to proceed, shop drawing approval, completion of various stages of construction, substantial completion, punch list correction period, and final completion date.
- 13.1.5 A preliminary Application for Payment together with a Schedule of Values prepared in accordance with the CSI Masterformat. Include a separate line item each for labor and materials as requested.

END OF SECTION 00100

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SECTION 00301
PROPOSAL FORM

Date: _____

Rooms To Go
111 7th Avenue South, Suite 100
Franklin, Tennessee 37064

Attn: Mr. Harmon Jones

Re: Rooms To Go
Distribution Center Expansion
Dunn, North Carolina

Gentlemen:

The undersigned being familiar with the local conditions affecting the cost of the work and with the Drawings and Specifications for the proposed above referenced project as prepared by the Architect, hereby proposes and agrees if this proposal is accepted to enter into contract to supply labor, materials, services, and equipment necessary for the complete execution of all general construction work in strict accordance with the Drawings and Specifications for a lump sum of:

_____ DOLLARS (\$ _____)
(Write Out in Words) (Write in Figures)

_____ Consecutive Calendar Days

This bid is based upon proprietary brands as shown on the Drawings and/or specified.

The undersigned further proposes and agrees hereby to commence work with an adequate force and equipment immediately after being notified in writing to do so, and to complete all work as required by the Drawings and Specifications within the number of consecutive calendar days as itemized above.

In submitting this bid, it is understood that the right is reserved by the Owner or his representative to reject any or all bids, and it is agreed that this bid may not be withdrawn for a period of thirty (30) days from bid due date.

Rooms To Go Phase II Expansion
Dunn, NC

Proposal Form
00301-1

It is further acknowledged that, after thorough examination of the site, Drawings and Specifications, the above quoted prices do not include any changes or substitutions to specified materials or methods. Any proposed changes or substitutions are itemized by attachment herewith for consideration noting the appropriate Add or Deduct amount. (Reference documents for specifically requested alternates.)

Alternate prices and unit prices as requested in the bid documents to this proposal, are herewith included by separate attachments.

We propose to subcontract the following items of work to other firms as follows:

<u>Item of Work</u>	<u>Subcontractor Name and Address</u>
Demolition	
Sitework	
Landscape and Irrigation	
Site Concrete	
Asphalt Paving	
Building Concrete Foundations	
Building Concrete Floors	
Building Concrete Walls	
Floor Joint Filler	
Masonry Block	
Steel	
Carpentry	
Membrane Roofing	
Sealants	
Doors and Hardware	
Drywall	
Floor Covering	
Painting	
Overhead Doors	
Dock Equipment	
Canopies	
Plumbing	
Fire Sprinkler	
HVAC	
Electrical	
Fire Alarm	

Fire Alarm
Security Alarm

At the time of submission of this proposal, the undersigned has received the following Addenda (if any):

Addendum No.

Date

Name of Firm _____

By (Typed) _____

By (Signature) _____

Title _____

Official Address _____

Telephone No. _____

Attest:

Secretary

SEAL

List of Alternates

The following alternate and unit prices, as requested in the Bid Documents, are herewith included for consideration and made part of this proposal. Omission of requested alternate pricing will invalidate this proposal.

<u>No.</u>	<u>Description</u>	<u>Cost Adjustment/Time (Note ADD or DEDUCT)</u>

List of Unit Prices

Recommended Substitutions

The following substitutions and/or changes are herewith offered for consideration.

Description

Cost Adjustment
(Note ADD or DEDUCT)

Attach additional pages if necessary

PROPOSAL BREAKDOWN

ROOMS TO GO

DESCRIPTION

DIVISION 1 – GENERAL CONDITIONS

Contractor General Conditions \$ _____

Contractor Fee \$ _____

TOTAL GENERAL CONDITIONS \$ _____

DIVISION 2 – SITEWORK

Demolition/Site Clearing \$ _____

Earthwork \$ _____

Drainage/Utilities \$ _____

- Storm Water \$ _____

- Natural Gas \$ _____

- Electrical \$ _____

- Fire Water \$ _____

Roads/Parking/Walks

\$ _____

- Asphalt Paving \$ _____

- Stripping \$ _____

- Site Concrete \$ _____

- Joint Fillers \$ _____

Landscaping/Lawn Irrigation \$ _____

Termite Treatment \$ _____

Site Lighting \$ _____

Site Fencing \$ _____

TOTAL SITEWORK \$ _____

DIVISION 3 – CONCRETE

Concrete \$ _____

- Foundations/Footings

- Floor Slab

Tilt-Up Wall Panels
Floor Sealer/Hardener
Floor Joint Filler

\$ _____
\$ _____
\$ _____

DIVISION 4 – MASONRY

Masonry
- Concrete Block

\$ _____

DIVISION 5 – METALS

Structural Metals - Materials
Structural Metals - Erection
Miscellaneous Metals

\$ _____
\$ _____
\$ _____

DIVISION 6 – CARPENTRY

Carpentry
- Wood Blocking/Nailers
- Miscellaneous Carpentry

\$ _____

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

Roofing and Accessories
- Roofing
- Flashing and Sheet Metal
- Downspouts/Collector Boxes
Joint Sealants

\$ _____
\$ _____

DIVISION 8 – DOORS AND WINDOWS

Doors/Frames/Hardware
Overhead Doors

\$ _____
\$ _____

DIVISION 9 – FINISHES

Drywall

\$ _____

- Steel Studs, Furring
- Wall Board
Flooring
Painting

\$ _____
\$ _____

DIVISION 10 – SPECIALTIES

Toilet Partitions
Toilet Accessories
Metal Canopies - Dock
Fire Extinguishers
Miscellaneous Specialties

\$ _____
\$ _____
\$ _____
\$ _____
\$ _____

DIVISION 11 – EQUIPMENT

Loading Dock Equipment

- Pit Levelers
- Bumpers

\$ _____
\$ _____

\$ _____

DIVISION 15 – MECHANICAL

Plumbing

- Basic Materials
- Domestic Water Piping
- Sanitary Waste Piping
- Vent Piping
- Water Heater
- Water Cooler
- Lavatories
- Urinal
- Water Closet
- Pipe Insulation
- Floor Drains
- Sinks

\$ _____

Fire Protection

\$ _____

HVAC

- Basic Materials
- Air Distribution
- Controls
- Insulation
- Exhaust Fans

\$ _____

\$ _____

- Ridge RTUs \$ _____

DIVISION 16 – ELECTRICAL

Electrical/Lighting \$ _____

- Basic Materials
- Power Distribution Systems
- Grounding
- Interior Lighting
- Building Mounted Exterior Lighting
- Exit Signage
- Emergency Lighting
- Telephone Service
- Fire Alarm
- Security Alarm

\$ _____
\$ _____

TOTAL BUILDING (DIVISIONS 3 THRU 16) \$ _____

TOTAL BASE BID \$ _____

END OF SECTION 00301

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SECTION 00320
GEOTECHNICAL REPORT

See Bid Document Exhibits for Geotechnical Report:

END OF SECTION 00320

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SECTION 00500

AGREEMENT

See the following Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum:

END OF SECTION 00500

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AIA® Document A101® – 2017

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

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

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

11540 Highway 92 East
Seffner, FL 33584

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

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

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

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, INSURANCE AND BONDS
- 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 listed in the General Conditions 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:*

(Paragraphs deleted)

§ 3.1.1 The Contractor shall not proceed with the Work until the Owner receives a Certificate of Insurance with coverage as agreed upon in the Contract Documents.

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

§ 3.3 Substantial Completion

§ 3.3.1 The Contractor shall achieve Substantial Completion of the entire

(Paragraphs deleted)

Work not later than NUMBER OF DAYS TBD) calendar days from the date of commencement of the

(Paragraphs deleted)

Work, subject to adjustments of this Contract Time as provided in the Contract Documents. § 3.3.2 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.

(Table deleted)

(Paragraph deleted)

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 and .00/100 dollars (\$), subject to additions and deductions as provided in the Contract Documents. There shall be no additions to the Contract Sum as a result of any price increase in Contractor's cost of labor, services or materials that occur after the Contract is signed by Contractor.

Init.

§ 4.2 Alternates and Clarifications

§ 4.2.1 Alternates and Clarifications, if any, which are described in the Contract Documents are hereby accepted and included in the Contract Sum by the Owner:

DIVISION	CLARIFICATIONS
	1.
	1.

§ 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.

(Paragraph deleted)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum: None.

Item	Price

§ 4.4 Unit prices, if any:

(Paragraph deleted)

Item	Units and Limitations	Price per Unit (\$0.00)

§ 4.5 Liquidated damages, if any:

(Paragraphs deleted)

See AIA Document A201-2007, Section 9.8 Substantial 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 Owner by the Contractor and Certificates for Payment issued by the Owner, 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 Twenty-Fifth (25th) day of the month.

§ 5.1.3 Provided that a fully completed Application for Payment, together with required supporting documents, is received by the Owner not later than the twenty-fifth (25th) day of a month, the Owner shall make payment of the certified amount to the Contractor not later than the tenth (10th) day of the following month. If an Application for Payment is received by the Owner after the application date fixed above, payment shall be made by the Owner not later than twenty (20) days after the Owner receives the fully completed Application for Payment together with required supporting documents.

(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 Owner may require. This schedule of values, unless objected to by the Owner, shall be used as a basis for reviewing the Contractor's Applications for Payment.

Init.

§ 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 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

- .1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of ten percent (10%). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided Section 7.3.9 of AIA Document A201-2007, General Conditions of the Contract for Construction;
- .2 Add 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, less retainage of ten percent (10%);
- .3 Subtract the aggregate of previous payments made by the Owner;
- .4 Subtract amounts, if any, for which the Owner has withheld or nullified a Certificate for Payment as provided in Section 9.5 of AIA Document A201-2007;
- .5 Add, upon Substantial Completion of Work, a sum sufficient to increase the total payments to the ninety-five percent (95%) of the Contract Sum, less such amounts as the Owner shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and
- .6 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of AIA Document A201-2007.

(Paragraphs deleted)

§ 5.1.7 Retainage

§ 5.1.7.1

(Paragraphs deleted)

Reduction or limitation of retainage, if any, shall be as follows: None.

(Paragraphs deleted)

§ 5.1.8 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.

(Paragraph deleted)

§ 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 A201-2007, and to satisfy other requirements, if any, which extend beyond final payment; and
- .2 a final Certificate for Payment has been approved and issued by the Owner.

§ 5.2.2 The Owner's final payment to the Contractor will be made within 30 days of Substantial Completion and receipt of the following:

- .1 fully executed lien documents from Contractor, subcontractors and suppliers;
- .2 two paper copy sets and two digital/electronic copy sets of as-built drawings, warranty and maintenance document manuals;
- .3 final unconditional Certificate of Occupancy;
- .4 all punch list work has been completed and accepted;
- .5 fully executed final change order(s); and
- .6 all warranty work through date of acceptance of items 1-5 has been completed and accepted from Contractor, subcontractors and suppliers.

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at

Init.

(Paragraphs deleted)

Chase Manhattan Prime Rate plus two percent (2%).

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

(Paragraphs deleted)

There shall not be an Initial Decision Maker, and all references in the Contract Documents to an Initial Decision Maker are hereby void.

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201-2007, the method of binding dispute resolution shall

(Paragraphs deleted)

be litigation in a court of competent jurisdiction. OWNER AND CONTRACTOR WAIVE ANY RIGHT TO TRIAL BY JURY AND, INSTEAD, CHOOSE TO HAVE ANY SUCH DISPUTE RESOLVED BY A JUDGE.

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 A201-2007.

(Paragraphs deleted)

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201-2007.

ARTICLE 8 MISCELLANEOUS PROVISIONS, INSURANCE AND BONDS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201-2007 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representatives:

(Name, address, email address, and other information)

Harmon H. Jones

§ 8.3 The Contractor's representatives:

(Name, address, email address, and other information)

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

§ 8.5 Insurance and Bonds

§ 8.5.1 The Contractor shall purchase and maintain insurance as set forth in Article 11 of AIA Document A201-2007, General Conditions of the Contract for Construction, as modified, including without limitation identified limits of liability.

Type of insurance or bond
Workman's Compensation

Limit of liability or bond amount (\$0.00)

Coverage complying with all the requirements of the State the project is located and shall include Employer's Liability Insurance at a limit of not less than \$1,000,000.

Comprehensive General Liability
Bodily Injury & Personal Injury
Motor Vehicle Liability
Property Damage

\$3,000,000
\$2,000,000
\$1,000,000
\$1,000,000

Init.

(Paragraph deleted)

§ 8.6

(Paragraphs deleted)

Other provisions:

(Paragraphs deleted)

§ 8.6.1 The Owner will contract directly with an independent testing agency for testing and inspections. The Contractor is responsible for coordinating tests and inspections as required in the specifications and for correcting any work identified as non-compliant with the Contract Documents. The Contractor shall be responsible for the additional costs of re-testing failures, re-scheduling inspections, tests and/or inspections beyond the required Scope of Work and/or the omission of any required test or inspection.

§ 8.6.2 Photographs of the following items shall be submitted with the Application for Payment for same; rigid perimeter insulation; stored insulation materials on job site and materials in-place; electrical ground rods and ground connections for building service and site lighting; stored copper rods and/or cable materials on job site and materials in-place; paint primer and finish paint products for exterior metal (e.g. canopy roofing, roof cap, and tube steel entrance truss framing); stored paint materials on job site and materials in-place. The Contractor shall, at the Contractor's expense, uncover in-place Work as necessary to confirm materials used. The Contractor is responsible for any costs associated with outside inspection and/or testing required to confirm concealed work. Payment to the Contractor will be withheld until these conditions are met.

§ 8.6.3 The Contractor is responsible for restoration of off-site areas disturbed in performance of the Work.

§ 8.6.4 The Owner will contract directly for items as clarified in the pre-bid conference notes.

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents, except for Modifications issued after execution of this Agreement, are enumerated in the sections below:

- .1 AIA Document A101™-2017, Standard Form of Agreement Between Owner and Contractor (as modified).

(Paragraph deleted)

- .2 AIA Document A201™-2007, General Conditions of the Contract for Construction (as modified).

- .3 Drawings: See Exhibit B.

- .4 Specifications: See Exhibit C.

- .5 Addenda, if any:

Number	Date	Pages

(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.

- .6 Other documents forming part of the Contract Documents

Document	Title	Date	Pages
Exhibit A	Schedule of Values		
Exhibit B	List of Drawings		
Exhibit C	General Index for the Specification Manual		
Exhibit D	Affidavits and Lien Waiver Forms		

(Paragraphs deleted)

.7 Other documents, if any, listed below:

(Paragraphs deleted)

None.

This Agreement entered into as of the day and year first written above. The undersigned company represents that the undersigned individual is duly authorized by the company to execute and deliver this instrument on behalf of the company and to bind the company in all matters addressed herein.

OWNER (Signature)

Harmon H. Jones, Sr. Vice President

(Printed name and title)

CONTRACTOR (Signature)

(Printed name and title)

Contractor's License Number

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SECTION 00600

WAIVERS AND RELEASES

See the following Exhibit D containing the following:

1. CONTRACTOR'S PROGRESS PAYMENT AFFIDAVIT AND PARTIAL RELEASE
2. CONTRACTOR'S FINAL AFFIDAVIT AND RELEASE
3. SUBCONTRACTOR/MATERIAL SUPPLIER PARTIAL LIEN WAIVER AND RELEASE
4. FINAL WAIVER AND RELEASE OF LIEN

END OF SECTION 00600

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Exhibit D

CONTRACTOR'S PROGRESS PAYMENT AFFIDAVIT AND PARTIAL RELEASE

STATE OF _____
COUNTY OF _____

BEFORE ME, the undersigned authority, personally appeared _____
("affiant"), who after being by me first duly sworn, deposes and says that:

1. Affiant is _____ of _____, doing business in the State of _____
_____ (hereinafter called "**Contractor**").

2. Affiant hereby represents that he/she has authority to execute this Affidavit and a Partial Release for an on behalf of the Contractor.

3. Pursuant to a Contract dated _____ (hereinafter referred to as "**Contract**"), with _____ (hereinafter referred to as "**Owner**"), Contractor has furnished or caused to be furnished labor, material and services for the construction of certain improvements as more particularly set forth in said Contract.

4. Contractor represents that all work performed under the aforesaid Contract through the date of this Affidavit and Payment Application, as shown on the Payment Application, has been performed, and that all persons and firms who furnished material, labor and/or services incident to the completion of said work, and who have served a Notice to Owner, have been paid in full, except the following:

Name of Lienor

Amount Due

Type of Work

5. For and in consideration of this progress payment to Contractor in the amount of \$ _____ and all other previous payments paid by Owner to Contractor, Contractor does hereby unconditionally and forever remise, release, acquit, satisfy and forever discharge the Owner, its employees, officers, directors, shareholders, representatives, agents, affiliates, subsidiaries, successors and assigns of, from and on account of any and all obligations, liabilities, claims, costs, fees, charges, expenses, suits, actions and causes of action (whether matured or unmatured, at law or in equity, in contract or in tort negligent or intentional, foreseen or unforeseen, known or unknown, liquidated or unliquidated, or otherwise) that the Contractor, its successors or assigns, or any one associated or identified with the Contractor now has or ever had, including, but not limited to any and all liens and claims of lien for labor, services and materials furnished to the property or the improvements as set forth in the Contract, through the date of ___ this Affidavit and Payment Application.

6. Contractor represents and warrants to the Owner that all labor and materials furnished by or on behalf of Contractor under the Contract are free from defects in materials and workmanship.

7. Contractor makes this affidavit and Release for the express purpose of inducing Owner to make this disbursement and progress payment to the Contractor in the amount of \$_____.

8. The Affidavit and Release is made by Contractor and full knowledge of the applicable laws of the State of _____. In addition to such rights as may be afforded to Owner under said applicable laws, Contractor expressly agrees to indemnify and save Owner harmless from any and all actual costs and expenses, including reasonable attorneys' fees, arising out of claims by laborers, subcontractors or materialmen who might claim that they have not been paid for services or materials furnished by or through the Contractor in connection with the work performed under the aforementioned Contract.

CONTRACTOR:

By: _____

(insert name of affiant)

STATE OF _____
COUNTY OF _____

The foregoing instrument was acknowledged before me this _____ day of _____, 20____ by (____ insert name of officer or agent ____) of (____ insert state or place of incorporation ____) corporation, on behalf of the corporation. He/She is personally known to me or has produced (____ insert type of identification ____) as identification.

(Notarial Seal)

Printed Name: _____

NOTARY PUBLIC

Commission Number: _____

State of _____ at Large

My Commission Expires: _____

CONTRACTOR'S FINAL AFFIDAVIT AND RELEASE

STATE OF _____
COUNTY OF _____

BEFORE ME, the undersigned authority, personally appeared _____
_____(**"affiant"**), who after being by me first duly sworn, deposes and says that:

1. Affiant is _____ of _____, doing business in the State of _____
_____(hereinafter called **"Contractor"**).

2. Affiant hereby represents that he/she has authority to execute this Affidavit and a Release for and on behalf of the Contractor.

3. Pursuant to a Contract dated _____(hereinafter referred to as **"Contract"**), with _____(hereinafter referred to as **"Owner"**), Contractor has furnished or caused to be furnished labor, material and services for the construction of certain improvements as more particularly set forth in said Contract.

4. Contractor represents that all work performed under the aforesaid Contract has been fully completed, and that all persons and firms who furnished material, labor and/or services incident to the completion of said work have been paid in full, except the following.

<u>Name of Lienor</u>	<u>Amount Due</u>	<u>Type of Work</u>

5. For and in consideration of final payment to Contractor in the amount of \$ _____ and all other previous payments paid by Owner to Contractor, Contractor does hereby unconditionally and forever remise, release, acquit, satisfy and forever discharge the Owner, its employees, officers, directors, shareholders, representatives, agents, affiliates, subsidiaries, successors and assigns of, from and on account of any and all obligations, liabilities, claims, costs, fees, charges, expenses, suits, actions and causes of action (whether matured or unmatured, at law or in equity, in contract or in tort negligent or intentional, foreseen or unforeseen, known or unknown, liquidated or unliquidated, or otherwise) that the Contractor, its successors or assigns, or any one associated or identified with the Contractor now has or ever had, including, but not limited to any and all liens and claims of lien for labor, services and materials furnished to the property or the improvements as set forth in the Contract, through the date of this Affidavit and Payment Application.

6. Contractor represents and warrants to the Owner that all labor and materials furnished by or on behalf of Contractor under the Contract are free from defects in materials and workmanship.

7. Contractor makes this Affidavit and Release for the express purpose of inducing Owner to make final disbursement and payment to the Contractor in the amount of \$ _____.

8. This Affidavit and Release is made by Contractor with full knowledge of the applicable laws of the State of _____. In addition to such rights as may be afforded to Owner under said applicable laws, Contractor expressly agrees to indemnify and save Owner harmless from any and all actual costs and expenses, including reasonable attorneys' fees, arising out of claims by laborers, subcontractors or materialmen who might claim that they have not been paid for services or materials furnished by or through the Contractor in connection with the work performed under the aforementioned Contract.

CONTRACTOR:

By: _____

(insert name of affiant)

STATE OF _____
COUNTY OF _____

The foregoing instrument was acknowledged before me this _____ day of _____ 20__ by (_____ insert name of officer or agent) of (_____ insert state or place of incorporation) corporation, on behalf of the corporation. He/She is personally known to me or has produced (_____ insert type of identification) as identification.

(Notarial Seal)

Printed Name: _____

NOTARY PUBLIC

Commission Number: _____

State of _____ at Large

My Commission Expires: _____

**SUBCONTRACTOR/MATERIAL SUPPLIER
PARTIAL LIEN WAIVER AND RELEASE**

STATE OF _____
COUNTY OF _____

WHEREAS, the undersigned _____ (“Subcontractor/Material Supplier”) has contracted with _____ (“Contractor”) to furnish certain material and/or labor (the “Contract”), more particularly described as _____ (the “Project”).

NOW, THEREFORE, the undersigned, for good and valuable consideration of \$ _____ the receipt and sufficiency of which is hereby acknowledged, does hereby unconditionally and forever waive, discharge, and release in favor of the Owner, any and all liens and claims of lien on the above described real property, on account of the labor or material, or both, furnished for or incorporated into the real property of improvements thereon by the undersigned. By execution hereof, Subcontractor/Material Supplier represents and warrants to both the Contractor and the Owner, that all labor and materials furnished by Subcontractor/Material Supplier are free of defects in materials or workmanship. The lien or both, furnished or incorporated into the subject property through _____ 25, 20_ (date of payment application).

Subcontractor/Material Supplier does hereby unconditionally and forever remise, release, acquit, satisfy and forever discharge both the Contractor and the Owner, its employees, officers, representatives, agents, affiliates, subsidiaries, successors and assigns of, from and on account of any and all obligations, liabilities, claims, debts, demands, damages, deficiencies, accounts, rights, costs, fees, charges, expenses, suits actions and causes of action (whether matured or unmatured, at law or in equity, in contract or in tort, negligent or intentional foreseen, known or unknown, liquidated or unliquidated, or otherwise), that the Subcontractor/Material Supplier, its successors or assigns, or any one associated or identified with the Subcontractor/Material Supplier now has or ever had against both the Contractor and the Owner.

Signed, sealed and delivered this _____ day of _____, 20_____.

Subcontractor/Material Supplier: _____

Signed: _____

(Name of Signor)
(Title of Signor)

(Seal)

BEFORE ME, the undersigned authority, personally appeared _____, who after being duly sworn, acknowledged that: (a) has been expressly and explicitly authorized and directed to execute and deliver this Partial Lien Waiver and Release on behalf of Subcontractor/Material Supplier; (b) he has property authority to act on behalf of Subcontractor in connection with this matter; (c) he has read and completely understands the term and effect of the foregoing document; (d) he intends the foregoing document to constitute a partial and unconditional release of any and all claims, and a waiver of any and all liens against the property; and (e) he has executed and acknowledged the foregoing document voluntarily intending to bind Subcontractor.

Sworn to and subscribed on _____, 20_____.

My commission expires: _____

Notary Public

State of

FINAL WAIVER AND RELEASE OF LIEN

STATE OF _____
COUNTY OF _____

The undersigned Mechanic, Subcontractor and/or Materialman, _____ (hereinafter of "Subcontractor") has been contracted/employed by _____ to furnish _____ (describe materials and/or labor) for construction of improvements known as _____ (hereinafter the "Project") which is located in the City of _____, County of _____, State of _____ and is owned by _____ and more particularly described as: _____ (hereinafter the "Property").

The Subcontractor acknowledges receipt of the final payment requested, including retainage and all other amounts due, in the amount of \$_____ and waives and releases any and all liens or claims of liens it has upon the Property or any bond, and releases Owner, Contractor and any tenant(s) from any claim, liability, or debt on account of labor or materials, or both, furnished by the undersigned to or on account of said Contractor for the Project or property, including, without limitation, any claim for change orders, extras or charges of any description.

The Subcontractor further represents and certifies that no lien has been filed against the described Property by Subcontractor or any laborer, Sub-Subcontractor or Materialman who has directly or indirectly furnished labor, services, equipment, rentals or materials to or for the Project, and the Subcontractor has paid all bills, taxes (including applicable Sales and use Taxes) and charges at the agreed prices for all of said labor, services, equipment, rentals and materials furnished to or for the Project through the closing date of _____.

Name of Subcontractor/Materialman

By: (Owner, Officer – Please designate)

Witness

Address

Before me, the undersigned authority, personally appeared _____, who, after being duly sworn, stated that he/she is _____ of _____; he/she is duly authorized to execute the foregoing on behalf of the firm; and he/she has executed the foregoing freely and voluntarily on behalf of the firm. _____ is personally known to me or has produced _____ as identification.

Notary of Public

(Notarial Seal)

Printed Name

State of _____
My Commission Expires: _____

SECTION 00700

GENERAL CONDITIONS

See the following General Conditions:

END OF SECTION 00700

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AIA® Document A201® – 2007

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

Rooms To Go Forms

THE OWNER:

(Name, legal status and address)

THE ARCHITECT:

(Name, legal status and address)

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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.

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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, Bidding Documents including without limitation the Advertisement or Invitation to Bid, the instructions to Bidders and Addenda or portions thereof relating to any Bidding Documents, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Bid Proposal or any portion therein shall not be a Contract document. 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 Owner. A Change Order Request shall not be a Modification to the Contract.

§ 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.

§ 1.1.3 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, Subcontractor, material supplier or other entity to fulfill the Contractor's obligations whether on or off the site of the Project. 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 that 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.

§ 1.1.7 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 INTENTIONALLY OMITTED

§ 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. Computed dimensions shall take precedence over scale dimensions and large scale drawings shall take precedence over small scale drawings.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 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 If there is an inconsistency in the Drawings, Specifications, or between the Drawings and the Specifications, or between existing site conditions and the Drawings and Specifications, unless otherwise ordered in writing by the Architect or the Owner, the Contractor shall provide the better quality of, or the greater quantity of, more stringent, or higher standard of Work or materials. The Contractor shall promptly, and no later than 48 hours after discovery, notify the Owner and Architect of any inconsistency found in the Drawings, Specifications, or between the Drawings and the Specifications and any existing site condition.

§ 1.2.5 Where a typical or representative detail is shown on the Drawings, such detail shall constitute the standard of workmanship and materials throughout corresponding portions of the Work. Where necessary, the Contractor shall adopt such detail for use in said corresponding portions of the Work in a manner that is satisfactory to 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 Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants are instruments of the Architect's service through which the Work to be executed by the Contractor is described. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment 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 this 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 material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them 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 material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner. All copies of the Instruments of Services, except the Contractor's record set, shall be returned or suitably accounted for to the Owner, on request, upon completion of the Work.

§ 1.5.3 Drawings issued by the Architect concerning clarifications, proposed changes (in form of "bulletins") or changes will be in the form of a reproducible print of each such Drawing. The Contractor, at his expenses, shall do all printing or duplication and distribution of such reproducible prints as necessary for the proper performance of the Work.

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

ARTICLE 2 OWNER

§ 2.1 GENERAL

§ 2.1.1 The Owner 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 Owner shall designate in writing a representative who shall have express

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authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide a written statement acknowledging that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract.

§ 2.2.2 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.

§ 2.2.3 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. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work, provided, however, Contractor shall review any such surveys, soil tests, or legal descriptions submitted by the Owner and notify the Owner within twenty (20) days of receipt of any inaccuracies.

§ 2.2.4 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.2.5 The Owner shall furnish to the Contractor one electronic copy of the Drawings and one electronic copy of the Specifications for purposes of making reproductions pursuant to Section 1.5.2. The Contractor shall furnish all other copies of the Drawings and Specifications necessary to perform the Work.

§ 2.3 OWNER'S RIGHT TO STOP THE WORK

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, 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, except to the extent required by Section 6.1.3. This right shall be in addition to and not in restriction or derogation of the Owner's rights under Article 14 hereof and shall not relieve the Contractor of any of his responsibilities and obligations under the Contract Documents.

§ 2.4 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, including the Contract Time, and fails within a five-day period after receipt of written notice from the Owner by letter, email, or progress meeting minutes to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, immediately correct such deficiencies, including supplementing the Contractor's forces to achieve Substantial Completion within the Contract Time. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies and/or supplementing Contractor's forces, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, at the Owner's option, the excess shall be deducted from any payment thereafter due or shall be paid by the Contractor immediately upon the demand of the Owner.

§ 2.5 ADDITIONAL RIGHTS

The rights stated in Article 2 shall be in addition to and not in limitation of any other rights of the Owner granted in the Contract Documents or at law or in equity.

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 obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Owner or Architect in their 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 and on-site conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before commencing 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 2.2.3, 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. The Contractor shall promptly report to the Owner any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect or Owner 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.

§ 3.2.3 The Contractor shall also ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of any governmental body or public or quasi-public authority. The Contractor shall promptly report to the Owner any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect or Owner may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Owner or Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities unless the Contractor should have recognized such error, inconsistency, omission, difference or nonconformity and failed to report it to the Owner. If the Contractor performs any construction activity when Contractor should have known it involves a recognized error, inconsistency, omission, difference or nonconformity in the Contract Documents or with existing site conditions without such notice to the Owner, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the attributable costs for correction.

§ 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, unless the Contract Documents give

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other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite 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 written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Owner or Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

§ 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 or claiming by, through or under the Contractor and for any damages, losses, costs and expenses resulting from such acts or omissions.

§ 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.

§ 3.4 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 Except in the case of minor changes in the Work authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 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.

§ 3.4.4 All manufactured articles, and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the respective manufacturers, unless otherwise specified.

§ 3.4.5 Contractor shall provide all manpower and deliver all materials at such times and in such quantities as will insure the speedy and uninterrupted progress of the Work and achieve Substantial Completion within the Contract Time. All materials shall be delivered to the Site in proper order and quantity. Contractor shall handle and protect all materials used in performance of the Work furnished by Contractor as the same are delivered to the Site, or to any applicable off-site storage location, and shall be solely responsible for the security and condition of the same. After final completion and acceptance of the Work, or sooner if requested by the Owner, Contractor shall remove all surplus materials, equipment, temporary structures and scaffolding furnished by it which have not been incorporated into the Work.

§ 3.4.6 Title to all materials shall immediately vest to the Owner upon payment in respect of such materials, whether or not then incorporated or installed into the Project, subject to the right of the Owner, or Architect to reject same for failure to conform to the standards of any of the Contract Documents. Title to all Work and materials shall be in owner, free and clear of all liens, claims, security interests or encumbrances.

§ 3.4.7 All materials furnished shall be new unless stated otherwise. When materials are specified to conform to any standard, the materials delivered to the Site shall bear manufacturers' labels stating that the materials meet such standards. The above requirements shall not restrict or affect Owner's right to test materials as provided in the Contract Documents.

§ 3.5 WARRANTY

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants

that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Owner or Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. The warranty given in this Paragraph shall survive and exceed any warranty limitation period set forth elsewhere in the Contract Documents.

§ 3.6 TAXES

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 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 as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work and will keep the Owner informed of any changes in applicable laws, ordinances, codes or permits affecting the Project. A photocopy of the building permit shall be delivered to the Architect and Owner as soon as it is obtained. Upon final completion, the Contractor shall deliver all original permits, licenses and certificates to the Owner and shall deliver photocopies to the Architect.

§ 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 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 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 2 days after first observance of the conditions. The Owner will promptly investigate such conditions and, if the Owner 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 make an equitable adjustment in the Contract Sum or Contract Time, or both. If the Owner 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 Owner shall promptly notify the Contractor in writing, stating the reasons. If the Contractor disputes the Owner's determination or recommendation, the Contractor may proceed as provided in Article 15. The Contractor shall not receive an adjustment in the Contract Sum or the Contract Time if such unknown or concealed condition is: (i) of a usual nature or does not differ materially from those ordinarily encountered and generally recognized as inherent in construction activities of the character provided for in the Contract Documents; (ii) located below the surface of the ground and does not differ materially from those generally encountered in the general area in which the site of the Project is located or does not differ materially from conditions encountered in any sub-surface investigation completed prior to the date of the Agreement; (iii) not materially different from those conditions disclosed or which reasonably should have been discerned by the Contractor's prior observations, field measurements, work, inspection, tests and reviews; and (iv) of a nature which the Contractor or any Subcontractor should reasonably know or anticipate based on any of the foregoing.

§ 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 the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has 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. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

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

§ 3.9 SUPERINTENDENT

§ 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 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner the name and qualifications of a proposed superintendent. The Owner may reply within 14 days to the Contractor in writing stating (1) whether the Owner has reasonable objection to the proposed superintendent or (2) that the Owner requires additional time to review. Failure of the Owner to reply within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 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. The Contractor shall provide the Owner with seventy-two (72) hours' notice of its intent to replace the superintendent.

§ 3.9.4 The Contractor shall require each Subcontractor for principal portions of the Work to provide a competent superintendent authorized to represent and speak on behalf of the Subcontractor at the Project site during the progress of the Work.

§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§ 3.10.1 The Contractor, promptly and no later than twenty-one days after being awarded the Contract, shall prepare and submit for the Owner's information a Contractor's construction schedule for the Work. The schedule shall not exceed the Contract Time set forth in the Contract Documents plus or minus any adjustments made to the Contract Time by an executed Change Order, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 3.10.2 The Contractor shall prepare a submittal schedule, promptly and no later than twenty-one days after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule and shall submit the schedule(s) for the Owner's and Architect's approval. The Owner's and Architect's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Owner and Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule or fails to submit according to the 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 strict accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.10.4 The Contractor also acknowledges and represents that it is aware that it will be required to accommodate the Owner's fixturing personnel up to four (4) weeks prior to Substantial Completion, which acknowledgment shall be reflected in the approved schedule. The Contractor shall coordinate the work of the Owner's fixturing personnel with the Work.

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Owner in good condition upon completion of the Work and before final payment is made as a record of the Work as constructed.

§ 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 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 the way by which 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.

§ 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 Owner or 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 requirements of the Contract Documents by the Owner's or Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Owner or Architect in writing 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 Owner's or 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 Owner or Architect on previous submittals. In the absence of such written notice, the Owner's or 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. 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 cause such services or certifications to be provided by a properly 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 and Owner. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, 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 and design criteria specified in the Contract Documents.

§ 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, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 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, and patching shall be restored to the condition existing prior to the cutting, fitting and 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 such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

§ 3.15 CLEANING UP

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or 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 thoroughly wash and clean all glass and mirror surfaces, and shall leave the Work neat and broom clean. The Contractor shall, not less than two times each week, clean up by removing rubbish, including old and surplus materials. The Contractor shall use its best efforts to prevent dust. The Contractor shall be responsible for the overall cleanliness and neatness of Work.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor and, at the option of the Owner, shall be deducted from the next payment to the Contractor or be paid by the Contractor to the Owner.

§ 3.15.3 Refer to the specification section pertaining to Final Cleaning for additional requirements and information.

§ 3.16 ACCESS TO WORK

The Contractor shall provide the Owner and Architect access to the Work in preparation and progress where ever located.

§ 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

The Contractor shall pay all royalties and license fees. The Contractor shall defend all suits or claims for infringement of copyrights and patent rights and shall save the Owner and Architect harmless from loss (including but not limited to, attorneys' fees and any litigation expenses) unless particular design, process or product of a particular manufacturer or manufacturers is specified in the Contract Documents; provided, however, if the Contractor has reason to believe that the required design, process or product specified is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless the Contractor promptly gives such information to the Architect and Owner.

§ 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law the Contractor shall indemnify 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 attorneys' fees, arising out of or resulting from performance of the Work, but only to the extent caused by the negligent 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.

§ 3.19 MEETINGS

The Contractor shall send his qualified representative to meetings held at the Project site every two weeks or at such time as the Architect or Owner shall designate.

§ 3.20 REPRESENTATIONS AND WARRANTIES

The Contractor represents and warrants the following to the Owner (in addition to the other representations and warranties contained in the Contract Documents), as an inducement to the Owner to execute the Agreement, which representations and warranties shall survive the execution and delivery of the Agreement and the final completion of the Work:

.1 that the Contractor is financially solvent, able to pay his debts as they mature and possessed of sufficient working capital to complete the Work and perform his obligations under the Contract Documents;

2 that the Contractor is able to furnish the plant, tools, materials, supplies, equipment and labor required to complete the Work and perform his obligations hereunder and has sufficient experience and competence to do so;

3 that the Contractor is authorized to do business in the State where the Project is located and properly licensed by all necessary governmental and public and quasi- public authorities having jurisdiction over the Contractor and over the Work and the site of the Project;

.4 that the execution of the Agreement and performance thereof is within the Contractor's duly authorized powers; and

.5 that the Contractor's duly authorized representative has visited the site of the Work, familiarized himself with the existing conditions under which the Work is to be performed and correlated his observations with the requirements of the Contract Documents and that Contractor is competent to perform the Work within the Contract Time and Contract Sum.

§ 3.21 SURETIES

The Contractor shall keep its surety and any surety for any Subcontractor informed of all information and occurrences as required by any surety bond on the Project.

ARTICLE 4 ARCHITECT

§ 4.1 GENERAL

§ 4.1.1 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.

§ 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. Consent shall not be unreasonably withheld.

§ 4.1.3 If the employment of the Architect is terminated, the Owner shall employ a successor architect whose status under the Contract Documents shall be that of the Architect.

§ 4.2 ADMINISTRATION OF THE CONTRACT

§ 4.2.1 The Owner and Architect will provide administration of the Contract as described in the Contract Documents during construction until the date the final payment is issued. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Owner and 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 Owner or Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. Neither the Owner nor the Architect will 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, except as provided in Section 3.3.1.

§ 4.2.3 The Owner will exercise care and diligence in discovering and promptly reporting any defects or deficiencies in the Work of the Contractor or any of his subcontractors or their agents or employees, or any other person performing any of the Work in the construction of the Project to the Contractor. The Owner and Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Owner and 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 FACILITATING CONTRACT ADMINISTRATION

Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

§ 4.2.5 Based on the Owner's evaluations of the Contractor's Applications for Payment, the Owner will review and approve the amounts due the Contractor.

§ 4.2.6 The Owner and Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Owner or Architect consider it necessary or advisable, the Owner or Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Owner or 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 Owner or Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Owner or 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 Owner's or 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 Owner's or Architect's 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 Owner's or Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Owner's or Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Owner or Architect, of any construction means, methods, techniques, sequences or procedures. The Owner's or Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Owner will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Owner will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion and will receive written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10

§ 4.2.10 Intentionally Omitted.

§ 4.2.11 The Owner or Architect as applicable will initially interpret and initially decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Owner's or Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect or Owner 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. When making such interpretations and decisions, the Owner or Architect as applicable will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith and without negligence.

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

§ 4.2.14 The Owner or Architect will review and respond to requests for information about the Contract Documents. The Owner's or 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 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 the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed

for each principal portion of the Work. The Owner or Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Owner or Architect requires additional time for review. Failure of the Owner or Architect to reply 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 responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 SUBCONTRACTUAL RELATIONS

§ 5.3.1 By appropriate agreement, written where legally required for validity, 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, which the Contractor, by these 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 Sub-subcontractors.

§ 5.3.2 Contractor shall furnish to Owner a copy of the master Subcontract form to be used within ten (10) days after the signing of this agreement.

§ 5.3.3 Any part of the Work performed for the Contractor by a Subcontractor shall be pursuant to a written Subcontract between the Contractor and such Subcontractor, which shall be prepared on a master form of Subcontract which contains provisions that:

.1 require that such portion of the Work be performed in accordance with the requirements of the Contract Documents;

.2 require timely submission of Subcontractor applications for payment with lien waivers/releases in order to enable the Contractor to apply for payment in accordance with the provisions of Article 9;

.3 waive all rights the subcontracting parties may have against one another or that the Subcontractor may have against the Owner for damages caused by fire or other perils covered by the property insurance described in Paragraph 11.3, except for such rights as they may have to the proceeds of such insurance held by the Owner under Subparagraph 11.3.9;

.4 recognize the rights of the Owner pursuant to the Contingent Assignment of Subcontracts under Subparagraph 5.4.1 and require the Subcontractor (upon notice by the Owner that the Owner has terminated the

Agreement with the Contractor pursuant to the terms of Article 14, and that the Owner has elected, pursuant to Subparagraph 5.4.1, to retain the Subcontractor pursuant to the terms of its Subcontract with the Contractor) to complete the unperformed obligations under such Subcontract and, if requested by the Owner, to enter into an appropriate agreement evidencing the fact that the Subcontractor is bound to the Owner under his Subcontract in the manner in which he had been bound to the Contractor;

.5 require the Subcontractor to carry and maintain insurance in accordance with the requirements of the Contract Documents; and

.6 contain no provisions inconsistent with any of the foregoing Subparagraphs .1 through .6 of this Subparagraph 5.3.3.

§ 5.3.4 Contractor's use of Subcontractors and Materialmen shall not diminish Contractor's obligation to complete the Work in accordance with the Contract Documents. Contractor shall control and coordinate the Work of its Subcontractors and Materialmen and shall provide and supervise sufficient and competent manpower and materials to perform the Work in accordance with the Contract Documents. Nothing contained in this Agreement shall create any contractual relationship between Subcontractors or Materialmen and Owner. Nothing in this Article shall obligate Owner to pay or to see to the payment of any sums to any Subcontractor or Materialmen.

§ 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 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor 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 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation may be equitably adjusted for increases in cost resulting from the suspension if appropriate.

§ 5.4.3 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

§ 5.5 PAYMENTS TO SUBCONTRACTORS BY THE CONTRACTOR

The Contractor shall pay each Subcontractor, no later than promptly upon receipt of payment from the Owner, an amount equal to the percentage of completion allowed to the Contractor on account of such Subcontractor's Work, less the percentage retained from payments to the Contractor. The Contractor shall also require each Subcontractor to make similar payments to its Sub-subcontractors.

§ 5.6 PAYMENTS TO SUBCONTRACTORS BY THE OWNER

§ 5.6.1 If the Owner fails to approve an Application for Payment for cause which the Owner determines is the fault of the Contractor and not the fault of a particular Subcontractor, or if the Contractor fails to make a payment which is properly due to a particular Subcontractor, the Owner may pay such Subcontractor directly, less the amount to be retained under his Subcontract. Any amount so paid by the Owner shall be repaid to the Owner by the Contractor in the manner set forth in Paragraph 2.4.

§ 5.6.2 The Owner shall have no obligation to pay, or to see to the payment of, any monies to any Subcontractor. Nothing contained in Paragraph 5.6 shall be deemed to create any contractual relationship between the Owner and any Subcontractor or to create any rights in any Subcontractor against the Owner.

§ 5.6.3 The Contractor shall promptly advise the Owner of any claim or demand by a Subcontractor claiming that any amount is due to such Subcontractor or claiming any default by the Contractor in any of its obligations to such Subcontractor.

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 Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

§ 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 other separate contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to the 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 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

§ 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 report to the Owner and Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report 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, except as to defects not then reasonably discoverable.

§ 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. 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 the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5 and shall indemnify, defend and hold harmless the Owner from any such damages or claims.

§ 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.

§ 6.3 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 Owner or 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 be based upon agreement among the Owner and Contractor; a Construction Change Directive is issued by the Owner and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

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

§ 7.2 CHANGE ORDERS

§ 7.2.1 A Change Order is a written instrument prepared by the Contractor and signed by the Owner and Contractor after execution of the Agreement 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 The compensation specified in a Change Order shall constitute an accord and satisfaction and full payment for the Work covered thereby and a complete release of and for all delay, impact and disruption costs or expenses occasioned by reason of said change in the Work.

§ 7.2.3 No time extension shall be granted Contractor by reason of the issuance of any Change Order unless expressly stated therein.

§ 7.2.4 Notwithstanding the generality of the foregoing, under no circumstances will the Contract Sum be adjusted on account or as a result of any occurrence or transaction arising out of or from the negligence or willful act or failure to act on the part of the Contractor.

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

§ 7.3.1 A Construction Change Directive is a written order prepared by the Owner or Architect and signed by the Owner or 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 or Architect 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, the Contract Sum and Contract Time being adjusted accordingly. Contractor shall immediately proceed with the change even if Contractor disagrees with the proposed adjustment, if any, to the Contract Sum or Contract Time so as to not delay completion of the Work. Any disagreement shall be resolved as set forth in 7.3.7 – 7.3.10 below.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 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 7.3.7.

§ 7.3.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that

application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 7.3.5 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with and complete the change in the Work involved. While proceeding with the change, Contractor shall also, within ten (10) days of receipt of the Construction Change Directive, advise the Owner 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 and/or Contract Time. If Contractor does not promptly proceed with the change in the Work, Contractor shall have waived and released any claim for any adjustment in the Contract Sum and/or Contract Time on account of the change and shall be liable to Owner for all direct and consequential damages incurred by Owner as a result of Contractor's delayed performance.

§ 7.3.6 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.

§ 7.3.7 If the Contractor does not respond within ten (10) days or disagrees with the method for adjustment in the Contract Sum, the Owner or Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Owner may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

- .1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
- .2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
- .5 Additional costs of supervision and field office personnel directly attributable to the change.

§ 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 Owner or 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 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Owner will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Owner determines to be reasonably justified. The Owner's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination 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 Contractor 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 and Owner have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order signed by the Architect and Owner and shall be binding on the Contractor.

ARTICLE 8 TIME

§ 8.1 DEFINITIONS

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including adjustments authorized in writing by the Owner, 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 Agreement.

§ 8.1.3 The date of Substantial Completion is the date of the final unconditional Certificate of Occupancy in accordance with Section 9.8.

§ 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 and that the Contractor is capable of properly completing the Work within the Contract Time.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

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

§ 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 If the critical path of the Project is delayed at any time in the commencement or progress of the Work by an act of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire outside of the Contractor's control, unusual delay in deliveries due solely to the acts of the carrier providing delivery, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation or by other causes that the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect or Owner may determine. Any change shall be an extension of the Contract Time only and the Contractor shall not seek or recover any damage for delay provided for in this Paragraph 8.3.1. The Contractor shall use best efforts to mitigate the effects of any such delay.

§ 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

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.

§ 9.2 SCHEDULE OF VALUES AND INITIAL SWORN STATEMENT

§ 9.2.1 The Contractor shall submit to the Owner, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Owner may require. This schedule, unless objected to by the Owner, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 9.2.2 Within thirty (30) days following commencement of the Work, the Contractor shall deliver to the Owner a Contractor's sworn statement, duly executed and acknowledge and in form satisfactory to the Owner, listing all Subcontracts.

Init.

§ 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 No later than the date established for each progress payment, the Contractor shall submit to the Owner three copies of AIA Document G702, Application and Certificate for Payment and AIA Document G703, Continuation Sheet, itemized in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. Such application shall be notarized and supported by such data substantiating the Contractor's right to payment as the Owner may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 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 material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or 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 the costs of 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 payments have been 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, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work. The Contractor shall satisfy or discharge and shall indemnify, defend and hold Owner harmless from any liens, claims, security interest or encumbrances filed by the Contractor, subcontractors, or anyone claiming by, through or under any of them, and will pay on demand any costs or attorneys' fees incurred by Owner if Contractor fails to satisfy, discharge or defend such liens, claims, security interest or encumbrance.

§ 9.3.4 Each Application for Payment shall be accompanied by the following, all in the form satisfactory to the Owner:

.1 duly executed waivers of construction mechanics' and materialmen's liens establishing payment or satisfaction of all such obligations to Subcontractors, required lower tier Subcontractors and Materialmen for the preceeding pay period; and

.2 Contractor's affidavit of payment and waiver of lien for Work done and materials furnished through the date covered by the last preceding partial payment and shall furnish its affidavit certifying that all Subcontractors and Materialmen have been paid for Work performed and materials furnished through such date except for any permitted retainage. Contractor shall attach to each Application or Requisition affidavits of payment and waivers of lien from all Subcontractors, providing labor and/or materials and/or equipment in connection with the Work, and Sub-subcontractors and materialmen who have given notice to Owner for such Work performed and materials furnished. Contractor shall execute a waiver of lien at the time payment is made for a Requisition for all Work performed through the date of Requisition in respect of which payment is being made, as a condition of such payment.

§ 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Owner will, within twenty days after receipt of a fully complete Contractor's Application for Payment and the documents required in Section 9.3.4 above, either pay such amount as the Owner determines is properly due, or notify the Contractor in writing of the reasons for withholding payment in whole or in part as provided in Section 9.5.1.

§ 9.4.2 Intentionally Omitted.

§ 9.5 DECISIONS TO WITHHOLD PAYMENT

§ 9.5.1 The Owner may withhold payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Owner's opinion the Work has not progressed to the point indicated in the Application for Payment or 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 for labor, materials or equipment, and/or to provide the duly executed waivers of construction mechanics' and materialmen's liens from Contractor, Subcontractors, required lower tier Subcontractors and Materialmen;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a separate contractor;
- .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 failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When the above reasons for withholding payment are removed, payment will be made for amounts previously withheld. The Owner shall not be deemed in default by reason of withholding payment while any of the above grounds remain uncured.

§ 9.5.3 If the Owner withholds 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 material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered.

§ 9.6 PROGRESS PAYMENTS

§ 9.6.1 The Owner shall make payment in the manner and within the time provided in the Contract Documents.

§ 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 Owner may, on request by any Subcontractor and at the Owner's discretion, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the 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 material and equipment 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 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, except as may otherwise be required by law.

§ 9.6.5 Contractor payments to material and equipment 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 and 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, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

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§ 9.6.8 Because flexibility in funding a project is beneficial to the completion of a successful project, Contractor agrees, and will cause its subcontractor's and materialmen to agree, to subordinate its and their construction, mechanic's and/or materialmen's lien to the mortgage lien of any third-party institutional lender on the Project.

§ 9.7 FAILURE OF PAYMENT

If the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount determined by the Owner, then the Contractor may, upon seven additional days' written notice to the Owner stop the Work until payment of the amount owing has been received.

§ 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. The date of Substantial Completion for this Project is and shall be the date of receipt of the final Unconditional Certificate of Occupancy. Owner and Contractor acknowledge that time is of the essence in completing the Project on time so that Owner can schedule the training and start date of its employees, schedule advertisements, deliver furniture and fixtures and so Owner's retail business can operate. They also acknowledge that Owner's damages from any failure to achieve Substantial Completion within the Contract Time will cause substantial damage to Owner and that the amount of that damage cannot be determined at this time. Owner and Contractor therefore agree to liquidate that damage as \$5,000 for each day beyond the Contract Time that the Project is not completed and Contractor agrees to pay Owner that amount for each such day.

§ 9.8.2 When the Owner considers that the Work, or a portion thereof which the Owner agrees to accept separately, is sufficiently complete to perform Punchlist Work, the Owner shall prepare and submit to the Contractor a comprehensive list of items to be completed or corrected (the "Punchlist"). 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. The Contractor shall complete all Punchlist work no later than fourteen (14) days after receipt of the Punchlist from the Owner. Contractor acknowledges that the Owner will suffer substantial harm after the Owner occupies the building and puts it to its intended use if the Punchlist work is not promptly performed. As such, the Contractor agrees to pay as liquidated damages, and not as a penalty, to the Owner \$350 per day for each day after the 14th day from receipt of that Punchlist that the Punchlist work is not complete. When the Punchlist work is completed, Contractor's Project Manager and Superintendent shall initial each item on the Punchlist indicating that each item has been performed.

§ 9.8.3 Upon receipt of the initialed Punchlist, the Owner will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Owner's inspection discloses any item, whether or not included on the Punchlist, which is not sufficiently complete in accordance with the Contract Documents the Contractor shall complete or correct such item upon notification by the Owner. In such case, the Contractor shall then submit a request for another inspection by the Owner to determine completion. The Contractor shall pay the Owner a reinspection fee ("Reinspection Fee") in the amount of \$400 for each reinspection required before the Work is complete and shall pay the travel costs for the Owner's representative to travel from their home office to the Project site for any reinspections.

§ 9.8.4 When the Work or designated portion thereof is complete, the Owner shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish 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.

§ 9.8.5 Upon Substantial Completion of the Work or designated portion thereof and upon application by the Contractor the Owner shall make payment of retainage applying to such 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.

§ 9.9 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 when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments,

retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Owner as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner and Contractor 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 written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Owner will promptly make such inspection and, when the Owner finds the Work acceptable under the Contract Documents and the Contract is fully performed, the Owner will within thirty (30) days issue final payment.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Owner in form and substance satisfactory to the Owner (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by 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; (5) final As-built drawings marked by the Contractor with record information as set forth in the Contract Documents; (6) warranty, maintenance and equipment operation documents; (7) a final Contractor's sworn statement from the Contractor duly executed and acknowledged showing all Subcontractors to be fully paid, and similar final sworn statements from Subcontractors and, where appropriate, from sub-subcontractors; and (8) other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor or sub-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 lien. If such lien remains unsatisfied after payments are made and is not bonded over as provided in the previous sentence, the Contractor shall promptly pay to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, and if the Contractor has provided all documents and materials required in the Contract Documents but final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, the Owner shall, upon application by the Contractor, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted provided, however, that the retainage held following such payment shall be in an amount equal to two hundred percent (200%) of the cost of finally completing the Work, including without limitation the items included on the Punchlist. 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 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 Owner prior to 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; or
- .3 terms of warranties required by the Contract Documents.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material 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.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 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 or the Contractor's Subcontractors or Sub-subcontractors; 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 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 owners and users of adjacent sites and utilities.

§ 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, except damage or loss 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.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition. The Contractor shall review the structural capability of the structure prior to allowing installation of temporary lifting devices or staging equipment or the temporary off-loading and storage of materials, and shall not exceed design loads without making modifications to building structure to support such loads. All modifications to building structure to support temporary loading shall be submitted to the Architect for review. Costs associated with the Architect's review or redesign of structure to accept temporary construction loading shall be borne by the Contractor.

(Paragraphs deleted)

§ 10.2.8 The Contractor shall replace and make good any loss or injury to the Owner's property or the Owner's tenants' property, the site or adjacent property resulting from the Contractor's negligent acts or omissions.

§ 10.2.9 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, written notice of such 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

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. 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 report the condition to the Owner and Architect in writing.

§ 10.3.2 Upon receipt of the Contractor's written 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 such material or substance or who are to perform the task of removal or safe containment of such 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 in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

§ 10.3.3 The Contractor shall take all necessary precautions for the safety of the Owner, its representatives and all persons in use or occupancy of the building as well as their licensees.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance 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 indemnify the Contractor for all cost and expense thereby incurred.

§ 10.3.7 The Contractor shall take all precautionary measures as required by all government authorities having jurisdiction over the Work as well as the Owner to prevent and correct fire causing conditions, and shall conduct all operations with due regard for the avoidance of fire hazards. The Contractor shall comply strictly with and enforce among all workmen on the job all fire and safety regulations of the Owner, including smoking regulations, as the same, from time to time, may be promulgated. Violation of any such regulations shall be cause for dismissal of the offender(s) from the Work. Nothing contained herein shall be construed to make the Owner responsible for the conduct of the Work by the Contractor.

§ 10.4 EMERGENCIES

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS
§ 11.1 CONTRACTOR'S LIABILITY INSURANCE

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies acceptable to the Owner and lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor, Owner and such other persons as the Owner may designate from time to time from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or sub-subcontractors or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- .1 Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;
- .2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- .3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- .4 Claims for damages insured by usual personal injury liability coverage;
- .5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- .6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- .7 Claims for bodily injury or property damage arising out of completed operations; and
- .8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Subparagraph 11.1.1 shall include Personal Injury Liability, Broad Form Property Damage Liability endorsement, Explosion, Collapse and Underground Damage Liability endorsement, and contractual Liability (applicable to the Contractor's obligations under Paragraph 3.18) insurance, and shall be written on an occurrence basis for not less than the following limits of liability, or any limits required by law, whichever is greater:

.1 Workmen's compensation insurance shall be written for not less than the statutory limits and shall include Employer's Liability Insurance at a limit of not less than One Million Dollars (\$1,000,000);

.2 Comprehensive General Liability insurance indemnifying and holding harmless the Owner, and the Architect as additional insured, including contractual liability coverage, shall be written for not less than Three Million Dollars (\$3,000,000); Bodily injury and personal injury shall be insured at a limit of not less than Two Million Dollars (\$2,000,000) for each occurrence and Two Million Dollars (\$2,000,000) total aggregate liability; Motor Vehicle Liability Coverage, with coverage limits not less than One Million Dollars (\$1,000,000);

.3 Property damage shall be insured at a limit of not less than One Million Dollars (\$1,000,000) total aggregate liability; and

§ 11.1.3 Prior to the commencement of the Work, Contractor shall file with the Owner valid certificates of Insurance and amendatory riders or endorsements to Contractor's insurance policies, all in form and substance satisfactory to the Owner, naming Owner and any subsidiary, parent or affiliate corporations of Owner and their directors, officers, agents and employees or other persons or entities with an insurable interest designated by Owner as additional insured thereunder. Said endorsements or amendatory riders shall indicate that as respects said additional insured, there shall be severability of interests under said insurance policies for all coverage's provided under said insurance policies. The certificates and amendatory riders or endorsements shall clearly indicate the specific coverage (including the contractual liability for the Contractor's obligations under Paragraph 3.18) and shall contain a provision requiring the giving of written notice to Owner until at least thirty (30) days prior to the cancellation, non-renewal or material modification of any such policies, as evidenced by return receipt of United States Certified or Registered Mail.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's consultants as additional insureds for claims caused in whole or in part

by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§ 11.1.5 If requested by the Owner after the date of the Agreement, the Contractor shall promptly procure, at the Owner's expense, liability insurance in such amounts as the Owner may request insuring against perils not listed in Subparagraph 11.1.1.

§ 11.1.6 If the Contractor fails to purchase or maintain or require to be purchased and maintained the liability insurance specified in Subparagraph 11.1.1, the Owner may (but shall not be obligated to) purchase such insurance on the Contractor's behalf and shall be entitled to be repaid for any premiums paid therefor by the Contractor in the manner set forth in Paragraph 2.4.

§ 11.1.7 When such insurance, due to the attainment of a normal expiration date or renewal date, shall expire, the Contractor shall, not less than thirty (30) days prior to such expiration or renewal date, supply the Owner with updated replacement certificates of insurance and amendatory riders or endorsements that clearly evidence the continuation of all coverage in the same manner, limits of protection, and scope of coverage, as was provided by the certificates and amendatory riders or endorsements originally supplied.

§ 11.2 OWNER'S LIABILITY INSURANCE

The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

§ 11.3 CONTRACTOR-SUPPLIED PROPERTY INSURANCE

§ 11.3.1 Builder's Risk Insurance. If required by the Contract, the Contractor shall purchase and maintain Builder's Risk insurance, in a form and with coverages acceptable to the Owner. Coverage shall be on an all-risk or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including theft, vandalism, malicious mischief, collapse, testing and startup, temporary buildings, and debris removal including demolition occasioned by the enforcement of law. Coverage shall be or 100% of the estimated completed replacement cost value of the Project (including all leasehold improvements, materials, and work to be incorporated into the Project). Such policy shall be written on a completed value form (100% non-reporting) without any coinsurance. In addition, the Builder's Risk policy shall:

a. Include coverage, in addition to the 100% completed replacement cost coverage, for at least 25% of the Project soft costs. Such soft costs coverage shall include without limitation advertising, design fees, professional fees, financing, lease administration, realty taxes, general administration, lease expenses, permit fees, insurance premiums, and including architects services and expenses as required as a result of a loss (including but not limited to interest expense; fees; and plans, specifications, blueprints and models, in connection with any restoration following an insured loss).

b. Include 100% coverage for flood unless the Project is located in a Flood Zone "A", as defined by the National Insurance Flood Plan. If the Project is located in a Flood Zone "A", Borrower shall maintain flood limits providing for the first 20% of the completed replacement cost, with a deductible not greater than 3% of completed replacement costs.

c. Include windstorm coverage with a deductible no greater than 5% of the estimated completed replacement cost value of the Project.

d. Include earthquake coverage with a sub-limit of no less than the first 25% of the completed replacement cost of the Project, unless the Project is located in Earthquake Mercalli Zone VII or greater. If the Project is located in an Earthquake Mercalli Zone VII or greater, Contractor shall maintain earthquake limits providing for the first 75% of the completed replacement cost, with a deductible not greater than 5% of completed replacement costs.

e. Include business income delay in completion coverage for a period of at least 6 months on an actual loss sustained basis, for benefit of Owner.

f. Include coverage for off-site storage of portions of the Work, portions of the Work in transit, and testing coverage for at least 90 days. Such coverage shall be for 100% of the replacement value of the completed property.

g. Not include in its limits, unless by separate limits, any tools, apparatus, machinery, scaffolding, hoists, forms, staging, shoring and other similar items commonly referred to as construction equipment which may be on the Project site and the capital value of which is not included in the Work. Contractor shall make its own arrangements for any insurance it may require on any construction equipment, and all such policies shall include a waiver of subrogation provision in favor of Owner.

h. Not include an exclusion for sidewalks, retaining walls, or underground property, nor an exclusion for interior water damage of any type.

i. Not contain a "permission to occupy" limitation.

j. Other than as specified above, have a deductible no greater than 1% of the estimated completed replacement cost value of the Project.

k. If limits are to be met via a policy that covers other projects (for example, a blanket limit policy), then that policy shall be endorsed to provide segregated limits for each of the limits and coverages required herein.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the property insurance requires minimum deductibles, the Contractor shall pay costs not covered because of such deductibles. If the Owner or insurer increases the required minimum deductibles above the amounts so identified or if the Owner elects to purchase this insurance with voluntary deductible amounts, the Owner shall be responsible for payment of the additional costs not covered because of such increased or voluntary deductibles. If deductibles are not identified in the Contract documents, the Owner shall pay costs not covered because of deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

(Paragraph deleted)

§ 11.3.2 EQUIPMENT BREAKDOWN/BOILER AND MACHINERY INSURANCE

If required by the Contract, the Contractor shall also maintain boiler and machinery insurance, which shall specifically cover loss or damage to any equipment to be installed or that is installed in the Project that is not otherwise covered by the Builders' Risk policy until final acceptance by the Owner. Such coverage shall specifically include hot and cold testing and start up coverage. This insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 All of the policies set forth in this section 11.3 shall be obtained from companies authorized to do business in the jurisdiction in which the Project is located, and shall be procured from companies with at least an "A-" financial strength rating and "VIII" financial size category from A.M. Best.

§ 11.3.4 If the Owner requests in writing that insurance for special hazards that are not encompassed by this Section 11.3, the Contractor shall, if possible, include such insurance, and the cost thereof shall be charged to the Owner by appropriate Change Order.

§ 11.3.5 All policies required by this Section 11.3 shall contain waivers of subrogation by endorsement or otherwise in favor of the Owner.

§ 11.3.6 Prior to commencing the Work, Contractor shall 1) provide Owner with copies of each policy required by this Section 11.3; 2) cause an Accord 27 Evidence of Property Insurance form to be issued by each insurer and provided to Owner, naming Owner as Loss Payee and Additional Interest on the policies required by this section, and requiring that Owner receive 30 days prior written notice of cancellation of non-renewal of any such policy; and 3) shall cause each policy to be endorsed with Owner as both an additional insured and as loss payee (as Owner's interests appear). All insurance shall insure interests of Owner, Contractor, and Subcontractors of all tiers in the Work.

§ 11.3.7 WAIVERS OF SUBROGATION

The Owner and Contractor waive all rights against (1) each other, any of their wholly owned subsidiaries and agents, their members, principals, officers and employees, and any subcontractors of any tier, agents and employees, each of the other and their wholly owned subsidiaries and agents, and (2) the Architect, Architect's consultants, separate contractors described in the Agreement, if any, and any of their subcontractors of any tier, agents and employees, (3) Landlord and its agents, members, officers and employees, and (4) Lender and its subsidiaries, agents, participants, officers and employees for any loss or damages to the extent of actual recovery of any insurance obtained pursuant to this Section 11.3 or other applicable insurance, except such rights as they may have to proceeds of such insurance held by the Owner or Contractor. The Contractor shall require similar written waivers in favor of the Owner and Contractor from all Subcontractors of any tiers and their agents and employees, the Architect, Architect's consultants, and separate contractors, if any. The foregoing waivers 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, even though that person or entity 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.

(Paragraph deleted)

§ 11.3.8. The Contractor shall promptly investigate and make a full written report to the Owner and any insurance carriers as to all alleged accidents and/or claims for damages relating to construction of the Project or relating to any other property of the Owner, including any damage or destruction to the Project or such other property and the estimated cost of repair and shall perform all necessary recordkeeping related to same. The Contractor shall do nothing to jeopardize the rights of the Owner and/or any other party insured under said policies. The Contractor shall notify Owner and any insurance carriers of any loss, and shall cooperate fully with any insurance carrier in connection with any such claim. A loss under any policy in this section 11.3 shall be diligently adjusted by the Contractor, at the Contractor's sole expense, in good faith on behalf of both Owner and Contractor, with loss made payable to either or both the Owner and Contractor as their interest may appear, subject, however, to requirements of any applicable mortgagee clause as may be required. The Contractor shall not settle any losses or portions of losses, complete loss reports, or endorse loss drafts without the prior written consent of the Owner. The Owner may at any time assume from the Contractor any or all rights and duties of adjustment and settlement, to the extent desired by the Owner at Owner's sole discretion, upon written notice to the Contractor.

§ 11.3.9 The Owner may, in its sole discretion, elect to receive all or any portion of any insurance payments, and will deposit in a separate account proceeds to received, which the Owner shall distribute in a good faith manner. In the event the Owner makes such election, the Contractor and Subcontractors of all tiers will, as necessary, instruct any insurer to make all payment directly to the Owner. If after such any loss no other special agreement is made, regarding loss payment that would cause sums to be paid to the Contractor (including Subcontractors of all tiers), then to that extent replacement of damaged property shall be covered by appropriate Change Order. Should any parties in interest (a term which does not include any insurer) object in writing, within 10 days of notice, to the manner of adjustment and/or settlement of any loss, resolution shall proceed as provided in Paragraph 15.3. The parties in interest shall, in that case, adjust and make settlement with insurers in accordance with the direction of tribunal. The Contractor shall pay Subcontractors their just share of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their sub-subcontractors in similar manner.

§ 11.3.10 Coverage under the policies required by this Section 11.3 shall be maintained for the full term of the Project until the acceptance of the completed Project by the Owner.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

§ 11.4.2 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.

§ 11.5 FAILURE TO PURCHASE OR MAINTAIN INSURANCE

If the Owner or the Contractor is damaged by failure of the other to purchase or maintain insurance required under Article 11 and so notifies the damaged party, then the party who failed to purchase or maintain the insurance shall bear all reasonable costs properly attributable thereto.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

§ 12.1.1 If a portion of the Work is covered contrary to the Owner's or Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Owner or Architect, be uncovered for the Owner's or Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Owner or Architect has not specifically requested to examine prior to its being covered, the Owner or 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, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

§ 12.2 CORRECTION OF WORK

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

The Contractor shall promptly correct Work rejected by the Owner or Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Owner's or Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 AFTER SUBSTANTIAL COMPLETION

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year 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, at the Contractor's sole expense, 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 and of the Substantial Completion of the Work. The Owner shall give such notice promptly after discovery of the condition. The notice may be sent by the Owner, the Tenant in possession of the Project, or a successor owner of the Project. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor 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 one-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.

§ 12.2.2.3 The one-year period for correction of Work shall 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 separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 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 one-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 Eleven (11) months after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established under Subparagraph 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, or after any extended period as set forth in Subparagraph 12.2.2, and before any warranty or correction period can expire, Contractor shall notify Owner that the warranty is about to expire and Contractor and Owner shall attend an on-site meeting and perform a thorough walk-through of the Project. The purpose of the walk-through is to identify any Work that is not in accordance with the requirements of the Contract Documents or any issues relating to any warranty, regardless of whether any such Work was identified on any prior punch list or Notification of Warranty Work/Request for Correction of the Work. Contractor shall promptly correct all such Work identified by the Owner. Contractor's correction or warranty period and obligations shall be extended for any additional time period until this walk-through is performed and until Contractor completely performs those corrections.

§ 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. The Work shall comply with all applicable laws, statutes, ordinances, codes, rules, regulations or orders during its performance and at its completion.

§ 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. The Contractor shall not assign the Contract as a whole or in part without written consent of the Owner. If the Contractor attempts to make such an assignment without such consent, the Contractor 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 such assignment.

§ 13.3 WRITTEN NOTICE

Except as provided elsewhere in this Agreement, written notice shall be deemed to have been duly served if delivered in person to the individual, to 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 or by courier service providing proof of delivery to, the last business address known to the party giving notice.

§ 13.4 RIGHTS AND REMEDIES

§ 13.4.1 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 at law or in equity.

§ 13.4.2 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.

§ 13.4.3 No provision contained in the Contract Documents shall create or give to third parties any claim or right of action against the Owner or the Contractor except as specifically provided herein.

§ 13.5 TESTS AND INSPECTIONS

§ 13.5.1 If the Contract Documents, or any laws, statutes, ordinances, building codes, rules, regulations or orders of any governmental body or public or quasi-public authority having jurisdiction over the Work or the site of the Project require any portion of the Work to be inspected, tested or approved, the Contractor shall give the Architect and Owner timely notice thereof so the Architect and Owner may observe such inspection, testing or approval. The Owner shall bear all costs of such inspections, tests or approvals except where the Contract Documents provide otherwise. Contractor shall secure any required certificates of inspection, testing or approval and promptly deliver them to the Architect and the Owner as provided in Article 8.7 of the Agreement.

§ 13.5.2 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 13.5.1, the Owner will perform or 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 Owner and Architect of when and where tests and inspections are to be made so that the Owner and Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 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 Owner's and Architect's services and expenses shall be at the Contractor's expense.

§ 13.5.4 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 Owner and Architect.

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

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

§ 13.5.7 No inspection or examination shall relieve the Contractor of the obligation to perform the Work in accordance with the Agreement. No payment, either partial or full, by the Owner to Contractor shall relieve Contractor of responsibility for complying with the Agreement. The Contractor shall remedy all defects and pay the cost of any damage to other work resulting therefrom.

§ 13.6 INTEREST

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

§ 13.7 TIME LIMITS ON CLAIMS

No action or proceeding shall lie or shall be maintained by the Contractor against the Owner or Architect unless such action or proceeding shall be commenced within six (6) months after the date payment is mailed or otherwise made in respect of the Final Application for Payment or, if this Contract is terminated by the Owner, unless such action or proceeding is commenced within six (6) months of the date of such termination.

§ 13.8 CLOSEOUT OF PROJECT

The Contractor shall provide all warranty documents, operation and maintenance manuals and as-built drawings to Owner within thirty (30) days after Substantial Completion. The Owner and Contractor acknowledge that damages will be suffered by the Owner in its operation of the completed building without the benefit of this documentation is difficult to quantify and therefore agree that the Contractor will be assessed liquidated damages, not as a penalty, in the amount of \$250 per day for each day following the date of Substantial Completion that the Owner has not been provided with all warranty documents, maintenance and operation manuals and as-built drawings.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 TERMINATION BY THE CONTRACTOR

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;
- .3 because the Owner has not made payment on an Application for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, 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 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner, terminate the Contract and recover from the Owner payment for Work executed.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1

(Paragraphs deleted)

If the Contractor shall institute proceedings or consent to proceedings requesting relief or arrangement under the Federal Bankruptcy Act or any similar or applicable federal or state law, or if a petition under any federal or state bankruptcy or insolvency law is filed against the Contractor and such petition is not dismissed within sixty (60) days from the date of said filing, or if the Contractor admits in writing his inability to pay his debts generally as they become due, or if he makes a general assignment for the benefit of his creditors, or if a receiver, liquidator, trustee or assignee is appointed on account of his bankruptcy or insolvency; or if a receiver of all or any substantial portion of the Contractor's properties is appointed; or if the Contractor abandons the Work; or if he fails, except in cases for which extension of time is provided, to prosecute promptly and diligently the Work or to supply enough properly skilled workmen or proper materials for the Work; or if he submits an Application for Payment, sworn statement, waiver of lien, affidavit or document of any nature whatsoever which is intentionally falsified; or if he fails to make prompt payment to Subcontractors or Suppliers for materials or labor or otherwise breaches his obligations under any subcontract with a Subcontractor; or if a mechanic's or materialman's lien or notice of lien is filed against any part of the Work or the site of the Project and not promptly bonded or insured over by the Contractor in a manner satisfactory to the Owner; or if the Contractor disregards any laws, statutes, ordinances, rules, regulations or orders of any

governmental body or public or quasi-public authority having jurisdiction of the Work or the site of the Project; or if he otherwise violates any provision of the Contract Documents; then the Owner, without prejudice to any right or remedy available to the Owner under the Contract Documents or at law or in equity, may, after giving the Contractor and the surety under the Performance Bond and under the Labor and Material Payment Bond described in Paragraph 11.4, seven (7) days' written notice, terminate the employment of the Contractor. If requested by the Owner, the Contractor shall remove any part or all of his equipment, machinery and supplies from the site of the Project within seven (7) days from the date of such request, and in the event of the Contractor's failure to do so, the Owner shall have the right to remove or store such equipment, machinery and supplies at the Contractor's expense. In case of such termination, the Contractor shall not be entitled to receive any further payment for Work performed by the Contractor through the date of termination. The Owner's right to terminate the Agreement pursuant to this Subparagraph 14.2.1 shall be in addition to and not in limitation of any rights or remedies existing hereunder or pursuant hereto or at law or in equity.

§ 14.2.2 When any of the above reasons exist, 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, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 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 all costs to the Owner of completing the Work, then the Contractor shall be paid for all Work performed by the Contractor to the date of termination. If such costs to the Owner of completing the Work exceed such unpaid balance, the Contractor shall pay the difference to the Owner immediately upon the Owner's demand. The costs to the Owner of completing the Work shall include (but not be limited to) the cost of any additional architectural, managerial and administrative services required thereby, any costs incurred in retaining another contractor or other subcontractors, any additional interest or fees which the Owner must pay by reason of a delay in completion of the Work, attorney's fees and expenses, and any other damages, costs and expenses the Owner may incur by reason of completing the Work or any delay thereof. The amount, if any, to be paid to the Contractor shall survive the termination of the Contract.

§ 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 as 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 as described in 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, upon seven (7) days' written notice to the Contractor, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

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SECTION 01100

SUMMARY OF WORK

PART 1 - GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Project consists of construction of an expansion of an existing Rooms To Go Distribution Center.
 - 1. Project Location: City of Dunn, Harnett County, North Carolina.
 - 2. Owner: Rooms To Go Distribution Company LLC.
- B. Contract Documents were prepared for the Project by HagerSmith Design, 301 S. Dawson St. Raleigh, NC 27601.
- C. Civil Engineering Contract Documents were prepared for the Project by The Site Group, PLLC, 1111 Oberlin Road, Raleigh, North Carolina 27605.
- C. The Work consists of an expansion of the main distribution facility, including demolition as required in the construction documents, site improvements and an expansion of an existing fire loop.
- D. The Owner intends to enter into a Contract for general construction including, but not necessarily limited to, site improvements, foundations, building structure, building cladding and roofing, mechanical, electrical, fire protection, plumbing, and finishes.

1.02 CONTRACTOR USE OF PREMISES

- A. General: During the construction period the Contractor shall coordinate use of premises as directed by Owner. Limit use of site for work and storage to allow:
 - 1. Work by other contractors.
 - 2. Space for Subcontractors' use.
- B. Use of the Site: Confine construction operations to work within site boundaries. Do not disturb portions of the site boundaries.
- C. The Contractor is responsible for restoration of offsite areas disturbed in the performance of the Work.

1.03 OCCUPANCY REQUIREMENTS

- A. Owner Use of Site: The Owner reserves the right of entry to completed, and partially completed, areas for performance of work under separate contracts.

1.04 PROGRESS PHOTOGRAPHS

- A. Provide 8 inch by 10 inch color, glossy finish progress photographs taken on the first day of each month during progress of the Work.
 - 1. Take photographs on a monthly basis; same day each month, weather permitting, and at the same time of day. Take photographs from the same locations each month.
 - 2. In addition to photographs from standard locations, take multiple photographs that best show significant elements of Work. Locations for these photographs shall be selected by the Contractor.
 - 3. When Work is complete, take final photographs from four separate locations determined by the Owner.
- B. Enlarge prints to a nominal 8 inch by 10 inch size. Note prints with the date of exposure. Include the project name, direction of view, and other pertinent data.
 - 1. Deliver two sets of progress prints directly to the Owner with the Contractor's Application for Payment.
 - 2. Deliver digital copy on CD directly to the Owner upon completion of Work.

1.05 FIRE PROTECTION COORDINATION AND RESPONSIBILITY

- A. It is the responsibility of all Contractors to thoroughly coordinate project installations to prevent wet-pipe sprinkler system installation obstructions identified by National Fire Protection Association and Factory Mutual requirements.
- B. All potential wet-pipe sprinkler system obstructions will not be identified on the drawings or design documents. Some may occur due to various infrastructure or other conditions during construction activities. It will be the responsibility of the Contractors to relocate, add, modify and pay for work as needed. The Owner, Design Engineers and Architects will not be responsible for problems or costs associated with contractor coordination.

1.05 MISCELLANEOUS PROVISIONS

- A. Accuracy of Existing Details: Details showing existing conditions are furnished for the Contractor's convenience and are representative of what the Architect and Owner believe to be the existing conditions. It is the responsibility of the Contractor to fully verify all existing conditions and related details.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

Not Applicable.

END OF SECTION 01100

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SECTION 01310

PROJECT COORDINATION

PART 1 - GENERAL

1.01 COORDINATION

- A. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
 - 3. Make provisions to accommodate items scheduled for later installation.
- B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
 - 1. Prepare similar memoranda for the Owner and separate subcontractors where coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of administrative procedures with other activities to avoid conflicts and assure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of schedules.
 - 2. Installation and removal of temporary facilities.
 - 3. Delivery and processing of submittals.
 - 4. Progress meetings.
 - 5. Project closeout activities.
 - 6. Submission of progress payment applications.
 - 7. Submission of lien waivers and affidavits.

1.02 SUBMITTALS

- A. General: Comply with Section 01330 "Submittals" and as specified herein.
- B. Coordination Drawings: Prepare coordination Drawings where close coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
 - 1. Show the relationship of components shown on separate Shop Drawings.
 - 2. Indicate required installation sequences.
- C. Staff Names: Within 15 days of commencement of construction operations, submit a list of Contractor's principal staff assignments, including the superintendent and other personnel in attendance at the Project site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.
 - 1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.
 - 2. Submit an updated list within 10 days of any revisions.
- D. Subcontractors Listing: Within 30 days of commencement of construction operations, submit a list of Subcontractors. Submit an updated list within 10 days of any revisions.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.01 GENERAL COORDINATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

3.02 CLEANING AND PROTECTION

- A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.
- B. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.
- C. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:
 - 1. Excessive static or dynamic loading.
 - 2. Excessive internal or external pressures.
 - 3. Excessively high or low temperatures.
 - 4. Thermal shock.
 - 5. Excessively high or low humidity.
 - 6. Air contamination or pollution.
 - 7. Water or ice.
 - 8. Solvents.
 - 9. Chemicals.
 - 10. Light.
 - 11. Radiation.
 - 12. Puncture.
 - 13. Abrasion.
 - 14. Heavy traffic.

END OF SECTION 01310

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SECTION 01320

PROJECT MEETINGS

PART 1 - GENERAL

1.01 PRECONSTRUCTION CONFERENCE

- A. Schedule a pre-construction conference before starting construction, at a time convenient to the Owner and the Architect, but no later than 30 days after execution of the Agreement. Hold the conference at the Project Site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
- B. Attendees: Authorized representatives of the Owner, Architect, their consultants; the Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants shall be familiar with the Project and authorized to conclude matters relating to the Work.
- C. Agenda: Discuss items of significance that could affect progress, including the following:
 - 1. Construction schedule.
 - 2. Critical Work sequencing.
 - 3. Designation of responsible personnel.
 - 4. Procedures for processing field decisions and Change Orders.
 - 5. Procedures for processing Applications for Payment.
 - 6. Distribution of Contract Documents.
 - 7. Submittal of Shop Drawings, Product Data and Samples.
 - 8. Preparation of record documents.
 - 9. Use of the premises.
 - 10. Office, work, and storage areas.
 - 11. Equipment deliveries and priorities.
 - 12. Safety procedures.
 - 13. First aid.
 - 14. Security.
 - 15. Housekeeping.
 - 16. Working hours.

1.02 PROGRESS MEETINGS

- A. Conduct progress meetings at the Project site not less than twice per month at regularly scheduled intervals. Notify the Owner of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.

- B. Attendees: In addition to representatives of the Owner, the Contractor, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.
 - 1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 2. Review the present and future needs of each entity present, including such items as:
 - a. Interface requirements.
 - b. Time.
 - c. Sequences.
 - d. Status of submittals.
 - e. Deliveries.
 - f. Off-site fabrication problems.
 - g. Access.
 - h. Site utilization.
 - i. Temporary facilities and services.
 - j. Hours of Work.
 - k. Hazards and risks.
 - l. Housekeeping.
 - m. Quality and work standards.
 - n. Change Orders.
 - o. Documentation of information for payment requests.
 - p. RFIs.
 - q. 3-week look ahead schedule.
 - r. Utility coordination.
 - s. Testing results.
- D. Reporting: No later than 3 days after each meeting, distribute minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

1. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

1.03 PREINSTALLATION MEETINGS

- A. Conduct project coordination meetings at regular intervals convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special preinstallation meetings.
- B. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.
- C. Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

Not Applicable.

END OF SECTION 01320

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SECTION 01330

SUBMITTALS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including the following:
 - 1. Contractor's construction schedule.
 - 2. Submittal schedule.
 - 3. Daily construction reports.
 - 4. Shop Drawings.
 - 5. Product Data.
 - 6. Samples.
 - 7. Quality assurance submittals.
- B. Contractor shall note that the Owner will retain two (2) copies of all submittals.

1.02 DEFINITIONS

- A. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.
 - 1. Preparation of Coordination Drawings is specified in Section 01310 "Project Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.
- B. Field Samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.
- C. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

1.03 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related activities to avoid delay.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review concurrently for coordination.
 - a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
 3. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.
 - a. Allow 2 weeks for initial review. Allow additional time if the Architect must delay processing to permit coordination with subsequent submittals.
 - b. If an intermediate submittal is necessary, process the same as the initial submittal.
 - c. Allow 2 weeks for reprocessing each submittal.
 - d. No extension of Contract Time will be authorized because of failure to transmit submittals sufficiently in advance of the Work to permit processing.
- B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
1. Provide a space approximately 4 by 5 inches on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
 2. Include the following information on the label for processing and recording action taken.
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Number and title of appropriate Specification Section.
 - i. Drawing number and detail references, as appropriate.
- C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Architect using a transmittal form. The Architect will not accept submittals received from sources other than the Contractor.
1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

2. Transmittal Form: Use AIA Document G810.

1.04 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart type, contractor's construction schedule. Submit prior to the date established for "Commencement of the Work."
 1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the breakdown of units of Work as indicated in the "Schedule of Values".
 2. Within each time bar indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
 3. Prepare the schedule on a sheet or sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
 4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the Work.
 5. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other schedules.
 6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the Schedule to allow time for the Architect's and Owner's procedures necessary for certification of Substantial Completion.
- B. Phasing: On the schedule, show how requirements for phased completion to permit Work by separate Contractors and partial occupancy by the Owner affect the sequence of Work.
- C. Work Stages: Indicate important stages of construction for each major portion of the Work, including submittal review, testing, and installation.
- D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the Work. Indicate where each element in an area must be sequenced or integrated with other activities.
- E. Cost Correlation: At the head of the schedule, provide a cost correlation line, indicating planned and actual cost. On the line, show dollar volume of Work performed as of the dates used for preparation of payment requests.

- F. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with the scheduled dates. Post copies in the Project meeting room and temporary field office.
 - 1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
 - 2. Schedule Updating: Revise the schedule after each meeting, event, or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.05 SUBMITTAL SCHEDULE

- A. After development and acceptance of the Contractor's Construction Schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for submittal of the Contractor's Construction Schedule.
 - 1. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products as well as the Contractor's Construction Schedule.
 - 2. Prepare the schedule in chronological order. Provide the following information:
 - a. Scheduled date for the first submittal.
 - b. Related Section number.
 - c. Submittal category (Shop Drawings, Product Data, or Samples).
 - d. Name of the subcontractor.
 - e. Description of the part of the Work covered.
 - f. Scheduled date for resubmittal.
 - g. Scheduled date the Architect's or Owner's final release or approval.
- B. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.
 - 1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
- C. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.06 DAILY CONSTRUCTION REPORTS

- A. Prepare a daily construction report recording the following information concerning events at the site, and submit duplicate copies to the Owner at weekly intervals or as requested by the Owner:
 - 1. List of Contractors at the site.
 - 2. Approximate count of personnel at the site.
 - 3. High and low temperatures, general weather conditions.
 - 4. Accidents and unusual events.
 - 5. Meetings and significant decisions.
 - 6. Stoppages, delays, shortages, and losses.
 - 7. Emergency procedures.
 - 8. Orders and requests of governing authorities.
 - 9. Change Orders received, implemented.
 - 10. Services connected, disconnected.
 - 11. Equipment or system tests and start-ups.
 - 12. Partial Completions, occupancies.
 - 13. Substantial Completions authorized.

1.07 SHOP DRAWINGS

- A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
- B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:
 - 1. Dimensions.
 - 2. Identification of products and materials included by sheet and detail number.
 - 3. Compliance with specified standards.
 - 4. Notation of coordination requirements.
 - 5. Notation of dimensions established by field measurement.
- C. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 36 by 48 inches.
- D. For initial submittal, and all required resubmittals, provide a PDF copy to the general contractor for review by Architect/Consultants. A combined copy of comments will be returned to the general contractor for distribution to sub-contractor.

- E. Do not use Shop Drawings without an appropriate final stamp indicating action taken.

1.08 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
 - 1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
 - a. Manufacturer's printed recommendations.
 - b. Compliance with trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Application of testing agency labels and seals.
 - e. Notation of dimensions verified by field measurement.
 - f. Notation of coordination requirements.
 - 2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
 - 3. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.
 - 4. Submittals: Submit 2 copies of each required submittal for the Architect and an additional 2 copies for the Owner; submit 4 copies where required for maintenance manuals. The Architect will retain copies and will return the other marked with action taken and corrections or modifications required.
 - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
 - 5. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
 - a. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
 - b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.09 SAMPLES

- A. Submit full-size, full fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
1. Mount, display, or package Samples in the manner to facilitate review of qualities indicated. Prepare Samples to match the Architect's Sample. Include the following:
 - a. Specification Section number and reference.
 - b. Generic description of the Sample.
 - c. Sample Source.
 - d. Product name or name of the manufacturer.
 - e. Compliance with recognized standards.
 - f. Availability and delivery time.
 2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
 - a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
 - b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
 - c. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.
 3. Preliminary Submittals: Submit a full set of choices where Samples are submitted for selection of color, pattern, texture, or similar characteristics from a range of standard choices.
 - a. The Architect or Owner will review and return preliminary submittals with the Architect's or Owner's notation, indicating selection and other action.
 4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 3 sets to the Architect. The Architect will return two sets marked with the action taken; one to the Contractor and one to the Owner.

5. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.
 - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
 - b. Sample sets may be used to obtain final acceptance of the construction associated with each set.
- B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.
 1. Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish the Project standard.
 - a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.10 QUALITY ASSURANCE SUBMITTALS

- A. Submit quality control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality control submittals as required under other Sections of the Specifications.
- B. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.
 1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.
- C. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Section 01400 "Quality Control Services."

1.11 ARCHITECT'S ACTION

- A. Except for submittals for the record or information, where action and return is required, the Architect will review each submittal, mark to indicate action taken, and return promptly.
 1. Compliance with specified characteristics is the Contractor's responsibility.

- B. Action Stamp: The Architect will stamp each submittal with a uniform action stamp. The Architect will mark the stamp appropriately to indicate action taken, as follows:
1. Final Unrestricted Release: When the Architect marks a submittal "Approved," the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
 2. Final-But-Restricted Release: When the Architect marks a submittal "Approved as Noted," the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.
 3. Returned for Resubmittal: When the Architect marks a submittal "Not Approved, Revise and Resubmit," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.
 - a. Do not use, or allow others to use, submittals marked "Not Approved, Revise and Resubmit" at the Project Site or elsewhere where Work is in progress.
 4. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Architect will return the submittal marked "Action Not Required."
- C. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Architect will return the submittal marked "Action Not Required."
- D. Contractor shall note that any approved submittal that does not conform to the Contract Documents requires written change order approval by the Owner.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

Not Applicable.

END OF SECTION 01330

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SECTION 01400

QUALITY CONTROL SERVICES

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for quality control services.
- B. Quality control services include inspections, tests, and related actions including reports, performed by Contractor, by independent agencies, and governing authorities. They do not include contract enforcement activities performed by Architect or the Owner.
- C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.
- D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.
 - 1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified inspections, tests, and related actions specified do not limit Contractor's quality control procedures that facilitate compliance with Contract Document requirements.
 - 3. Requirements for the Contractor to provide quality control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- E. Related Sections:
 - 1. Section 01330 "Submittals."
 - 2. Section 01731 "Cutting and Patching."

1.02 RESPONSIBILITIES

- A. Contractor Responsibilities: Unless otherwise specifically indicated as the responsibility of another identified entity, Contractor shall provide inspections, tests, and other quality control services specified elsewhere in the Contract Documents and required by governing authorities having jurisdiction. Costs for these services are included in the Contract Sum.

1. Where individual Sections specifically indicate that certain inspections, tests, and other quality control services are the Contractor's responsibility, the Contractor shall employ and pay a qualified testing agency to perform quality control services. Costs for these services are included in the Contract Sum.
 2. Where individual Sections specifically indicate that certain inspections, tests, and other quality control services are the Owner's responsibility, the Owner will employ and pay a qualified independent testing agency to perform those services.
- B. Retesting: The Contractor is responsible for retesting and/or additional testing where results of inspections, tests, or quality control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.
1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility, where required tests performed on original construction indicated noncompliance with Contract Document requirements.
- C. Associated Services: Cooperate with agencies performing inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services include, but are not limited to, the following:
1. Provide access to the Work.
 2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
 3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
 4. Provide facilities for storage and curing of test samples.
 5. Deliver samples to testing laboratories.
 6. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
 7. Provide security and protection of samples and test equipment at the Project site.
- D. Duties of the Testing Agency: The independent agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual Sections shall cooperate with the Architect, Owner and Contractor in performance of the agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.
1. The agency shall notify the Architect, Owner and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.
 3. The agency shall not perform any duties of the Contractor.
- E. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

1.03 SUBMITTALS

- A. Unless the Contractor is responsible for this service, the independent testing agency shall submit a certified written report of each inspection, test or similar service, to the Architect, Owner and Contractor. If the Contractor is responsible for the service, submit a certified written report, in duplicate, of each inspection, test, or similar service through the Contractor.
1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
 2. Report Data: Written reports of each inspection, test, or similar service include, but are not be limited to, the following:
 - a. Date of issue.
 - b. Project title and number.
 - c. Name, address, and telephone number of testing agency.
 - d. Dates and locations of samples and tests or inspections.
 - e. Names of individuals making the inspection or test.
 - f. Designation of the Work and test method.
 - g. Identification of product and Specification Section.
 - h. Complete inspection or test data.
 - i. Test results and an interpretation of test results.
 - j. Ambient conditions at the time of sample taking and testing.
 - k. Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements.
 - l. Name and signature of laboratory inspector.
 - m. Recommendations on retesting.

1.04 QUALITY ASSURANCE

- A. Qualification for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with the American Council of Independent Laboratories' "Recommended Requirements for Independent Laboratory Qualification" and that specialize in the types of inspections and tests to be performed.
 - 1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State of North Carolina.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.01 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample taking and similar services, the Contractor shall repair damaged construction and restore substrates and finishes. Comply with Contract Document requirements for Section 01731 "Cutting and Patching."
- B. Protect construction exposed by or for quality control service activities, and protect repaired construction.
- C. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

END OF SECTION 01400

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes requirements for construction facilities and temporary controls, including temporary utilities, support facilities, and security and protection.
- B. Temporary utilities include, but are not limited to, the following:
 - 1. Water service and distribution.
 - 2. Temporary electric power and light.
 - 3. Temporary heat.
 - 4. Ventilation.
 - 5. Telephone service.
 - 6. Sanitary facilities, including drinking water.
 - 7. Storm and sanitary sewer.
- C. Support facilities include, but are not limited to, the following:
 - 1. Field offices and storage sheds/trailers.
 - 2. Temporary roads and paving.
 - 3. Dewatering facilities and drains.
 - 4. Temporary enclosures.
 - 5. Hoists.
 - 6. Temporary project identification signs and bulletin boards.
 - 7. Waste disposal services.
 - 8. Rodent and pest control.
 - 9. Construction aid and miscellaneous services and facilities.
- D. Security and protection facilities include, but are not limited to, the following:
 - 1. Temporary fire protection.
 - 2. Barricades, warning signs, and lights.
 - 3. Enclosure fence for the site, with lockable entrance gates.
 - 4. Environmental protection.

1.02 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A10 Series: Safety Requirements for Construction and Demolition.
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 10: Standard for Portable Fire Extinguishers.
 - 2. NFPA 70: National Electrical Code.
 - 3. NFPA 241: Standard for Safeguarding Construction, Alterations, and Demolition Operations.

1.03 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
 - 1. Building code requirements.
 - 2. Health and safety regulations.
 - 3. Utility company regulations.
 - 4. Police, fire department, and rescue squad rules.
 - 5. Environmental protection regulations.
- B. Standards: Comply with NFPA 241, ANSI A10 Series standards, and NECA Electrical Design Library "Temporary Electrical Facilities".
 - 1. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70.
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.04 PROJECT CONDITIONS

- A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of the permanent service.

- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses if needed. Do not overload, or permit them to interfere with progress. Take necessary fire prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on the site.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General: Provide new materials. If acceptable to the Owner, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.
- B. Lumber and Plywood:
 - 1. For job-built temporary offices, shops, and sheds within the construction area, provide UL-labeled, fire-treated lumber and plywood for framing, sheathing, and siding.
 - 2. For signs and directory boards, provide exterior-type, Grade B-B high density concrete form overlay plywood of sizes and thicknesses indicated.
 - 3. For fences and vision barriers, provide minimum 3/8 inch thick exterior plywood.
 - 4. For safety barriers and similar uses, provide minimum 5/8 inch thick exterior plywood.
- C. Tarpaulins: Provide waterproof, fire-resistant, UL labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon reinforced, laminated polyethylene or polyvinyl chloride, fire retardant tarpaulins.
- D. Water: Provide potable water approved by local health authorities.
- E. Open-Mesh Fencing: Provide 0.120 inch thick, galvanized 2 inch chainlink fabric fencing 6 feet high with galvanized barbed wire top strand and galvanized steel pipe posts, 1-1/2 inches I.D. for line posts and 2-1/2 inches I.D. for corner posts.

2.02 EQUIPMENT

- A. General: Provide new equipment. If acceptable to the Owner, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.
- B. Water Hoses: Provide 3/4 inch, heavy duty, abrasion-resistant, flexible rubber hoses 100 feet long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.
- C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-Volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.
- D. Electrical Power Cords: Provide grounded extension cords. Use hard service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
- E. Lamps and Light Fixtures: Provide general service lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.
- F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM Global, or another recognized trade association related to the type of fuel being consumed.
- G. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Provide heated and air-conditioned units with toilet room on foundations adequate for normal loading.
- H. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated recirculation, or combustion type. Provide units properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material.
- I. Fire Extinguishers: Provide hand-carried, portable, UL rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations,

provide hand-carried, portable, UL-rated, Class ABC, dry chemical extinguishers or a combination of extinguishers of NFPA recommended classes for the exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
 1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
 3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
 4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect. Neither the Owner nor Architect will accept cost or use charges as a basis of claims for Change Orders.
- B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.
 1. Sterilization: Sterilize temporary water piping prior to use.
- C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.
 1. Install electric power service underground, except where overhead service must be used.
 2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, ac 20 Ampere rating, and lighting

circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

- D. Temporary Lighting: When overhead roof deck has been installed, provide temporary lighting with local switching.
 - 1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.
- E. Temporary Heat: Provide temporary heat required by construction activities for curing or drying of completed installations or for protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
- F. Heating Facilities: Except where the Owner authorizes use of the permanent system, provide vented, self-contained, LP gas or fuel oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.
- G. Sanitary facilities include temporary toilets, wash facilities, and drinking water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
 - 1. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.

- H. Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.
 - 1. Provide separate facilities for male and female personnel.
- I. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.
 - 1. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.
- J. Drinking Water Facilities: Provide containerized, tap-dispenser, bottled-water drinking water units, including paper supply.
 - 1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 degrees F.
- K. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent than can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
 - 1. Filter out excessive amounts of soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
 - 2. Connect temporary sewers to the municipal system as directed by sewer department officials.
 - 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.
 - 4. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.02 SUPPORT FACILITIES INSTALLATION

- A. Locate field offices, storage sheds/trailers, and other temporary construction and support facilities for easy access.

1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Provide incombustible construction for offices, shops, and sheds located within the construction area or within 30 feet of building lines. Comply with requirements of NFPA 241.
- C. Field Offices: Provide insulated, weathertight offices of sufficient size to accommodate required personnel at the Project Site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip offices as follows:
 1. Furnish with a desk and chairs, a 4-drawer file cabinet, plan table, plan rack, and a 6-shelf bookcase.
 2. Equip with a water cooler and private toilet complete with water closet, lavatory, and medicine cabinet unit with a mirror.
- D. Storage and Fabrication Sheds/Trailers: Install storage and fabrication sheds/trailers sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere on-site.
- E. Temporary Roads and Paving/Gravel: Construct and maintain temporary roads and paving/gravel to support the indicated loading adequately and to withstand exposure to traffic during the construction period. Locate temporary paving/gravel for roads, storage areas, and parking where the same permanent facilities will be located.
 1. Paving: Refer to Drawings for construction and maintenance of temporary paving/gravel.
 2. Coordinate temporary paving development with subgrade grading, compaction, installation, and stabilization of subbase, and installation of base and finish courses of permanent paving.
 3. Install temporary paving/gravel to minimize the need to rework the installations and to result in permanent roads and paved areas without damage or deterioration when occupied by the Owner.
 4. Delay installation of the final course of permanent asphalt concrete paving until immediately before Substantial Completion. Coordinate with weather conditions to avoid unsatisfactory results.
 5. Extend temporary paving/gravel in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration, and supervision.

- F. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Division 2 Sections. Where feasible, utilize the same facilities. Maintain the site, excavations, and construction free of water.
- G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, weather, other construction operations, and similar activities.
 - 1. Where heat is needed and the permanent building enclosure is not complete, provide enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
 - 2. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 sq. ft. or less with plywood or similar materials.
 - 3. Close openings through floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
 - 4. Where temporary wood or plywood enclosure exceeds 100 sq. ft. in area, use UL labeled, fire retardant treated material for framing and main sheathing.
- H. Temporary Lifts and Hoists: Provide facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- I. Project Identification and Temporary Signs: Prepare project identification and other signs of size indicated. Install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative treated wood or steel. All advertisement signs require Owner approval. Do not permit installation of unauthorized signs.
 - 1. Project Identification Signs: Engage an experienced sign painter to apply graphics. Comply with details indicated.
 - 2. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.
- J. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when Work is being performed.
- K. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 90 degrees F. Handle

hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

- L. Rodent and Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Employ this service to perform extermination and control procedures at regular intervals so the Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

3.03 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Owner.
- B. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against predictable and controllable fire losses. Comply with NFPA 10 and NFPA 241.
 - 1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than number of extinguishers required by governing Code.
 - 2. Store combustible materials in containers in fire-safe locations.
 - 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
 - 4. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.
- C. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
- D. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing lights.

- E. Enclosure Fence: Before excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.
 - 1. Provide open-mesh, chain-link fencing with posts set in a compacted mixture of gravel and earth.
- F. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
 - 1. Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.
- G. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.04 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour day basis to achieve indicated results and avoid the possibility of damage.
 - 2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Termination and Removal: Unless the Owner requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no

later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.
2. Remove temporary paving/gravel not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt, and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, sidewalks, and offsite areas at the temporary entrances, as required by the governing authority.
3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:
 - a. Replace air filters and clean inside of ductwork and housings.
 - b. Replace significantly worn parts and parts subject to unusual operating conditions.
 - c. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION 01500

SECTION 01600

MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes administrative and procedural requirements governing the Contractor's selection of products for use in the Project.

1.02 SUBMITTALS

- A. Product List: Prepare a list showing products specified in tabular form acceptable to the Architect. Include generic names of products required. Include the manufacturer's name and proprietary product names for each item listed.
 - 1. Coordinate product list with the Contractor's Construction Schedule and the Schedule of Submittals.
 - 2. Form: Prepare product list with information on each item tabulated under the following column headings:
 - a. Related Specification Section number.
 - b. Generic name used in Contract Documents.
 - c. Proprietary name, model number, and similar designations.
 - d. Manufacturer's name and address.
 - e. Supplier's name and address.
 - f. Installer's name and address.
 - g. Projected delivery date or time span of delivery period.
- B. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of an initial product list. Provide a written explanation for omissions of data and for known variations from Contract requirements.
 - 1. At Contractor's option, the initial submittal may be limited to product selections and designations that must be established early in the Contract period.
- C. Completed List: Within 45 days after date of commencement of the Work, submit 3 copies of the completed product list. Provide a written explanation for omissions of data and for known variation from Contract requirements.

- D. Architect's Action: The Architect will respond in writing to the Contractor within 2 weeks of receipt of the completed product list. No response within this time period constitutes no objection to listed manufacturers or products, but does not constitute a waiver of the requirement that products comply with Contract Documents. The Architect's response will include a list of unacceptable product selections, containing a brief explanation of reasons for this action.
1. A list of unacceptable product selections, containing a brief explanation of reasons for this action.

1.03 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.
1. When specified products are available only from sources that do not, or cannot, produce a quantity adequate to complete project requirements in a timely manner, consult with the Architect to determine the most important product qualities before proceeding. Qualities may include attributes, such as visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources producing products that possess these qualities, to the fullest extent possible.
- B. Compatibility of Options: When the Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options. The Contractor is responsible for coordination of installation for the product.
- C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior.
1. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.
 2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Delivery, store, and handle products according to manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft.
 - 1. Schedule delivery to minimize long-term storage and prevent overcrowding construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
 - 3. Deliver products to the site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.
 - 5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
 - 6. Store heavy materials away from the Project structures in a manner that will not endanger the supporting construction.
 - 7. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.
 - 8. Store products at the site in a manner that will minimize rusting, soiling, fading, swelling, shrinking, staining, cracking, warping, or other form of damage or deterioration.

PART 2 - PRODUCTS

2.01 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.
 - 1. Provide products complete with all accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
 - 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. Product Selection Procedures: The Contract Documents and governing regulations govern product selection.

PART 3 - EXECUTION

3.01 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
 - 1. Clean expose surfaces and protect as necessary to ensure freedom from damage and deterioration at the time of Substantial Completion.

END OF SECTION 01600

SECTION 01631

SUBSTITUTIONS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for handling requests for substitutions made after award of the Contract.
- B. Contractor shall note that each substitution request requires written change order acceptance by the Owner.

1.02 DEFINITIONS

- A. Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after award of the Contract are considered to be requests for substitutions. The following are not considered to be requests for substitutions:
 - 1. Substitutions requested during the bidding period, and accepted by Addendum prior to award of the Contract, are included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.
 - 2. Revisions to Contract Documents requested by the Owner or Architect.
 - 3. Specified options of products and construction methods included in the Contract Documents.
 - 4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.03 SUBMITTALS

- A. Substitution Request Submittal: The Architect and Owner will consider requests for substitution if received within 60 days after commencement of the Work. Requests received more than 60 days after commencement of the Work may be considered or rejected at the discretion of the Architect or Owner.
 - 1. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and according to procedures required for change order proposals.

2. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers.
3. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
 - a. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors, that will become necessary to accommodate the proposed substitution.
 - b. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as performance, weight, size, durability, and visual effect.
 - c. Product Data, including Drawings and descriptions of products, fabrication, and installation procedures.
 - d. Samples, where applicable or requested.
 - e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
 - f. Cost information, including a proposal of the net change, if any, in the Contract Sum.
 - g. The Contractor's certification that the proposed substitution conforms to requirements in the Contract Documents in every respect and is appropriate for the applications indicated.
 - h. The Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.
4. Architect's Action: If necessary, the Architect or Owner will request additional information or documentation for evaluation within one week or receipt of a request for substitution. The Architect or Owner will notify the Contractor of acceptance or rejection of the proposed substitution within 2 weeks of receipt of the request, or one week of receipt of additional information or documentation, whichever is later. Acceptance will be in the form of a signed change order by the Owner.
 - a. Use the product specified if the Architect or Owner cannot make a decision on the use of a proposed substitute within the time allocated.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

- A. Conditions: The Architect or Owner will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as determined by the Architect or Owner. If the following conditions are not satisfied, the Architect or Owner will return the requests without action except to record noncompliance with these requirements.
1. Extensive revisions to Contract Documents are not required.
 2. Proposed changes are in keeping with the general intent of the Contract Documents.
 3. The request is timely, fully documented, and properly submitted.
 4. The specified product or method of construction cannot be provided within the Contract Time. The Architect or Owner will not consider the request if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
 5. The request is directly related to an "or equal" clause or similar language in the Contract Documents.
 6. The requested substitution offers the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. The Owner's additional responsibilities may include compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner, and similar considerations.
 7. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
 8. The specified product or method of construction cannot be provided in a manner that is compatible with other materials and where the Contractor certifies that the substitution will overcome the incompatibility.
 9. The specified product or method of construction cannot be coordinated with other materials and where the Contractor certifies that the substitution can be coordinated.
 10. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.

- B. The Contractor's submittal and the Architect's acceptance of Shop Drawings, Product Data, or Samples for construction activities not complying with the Contract Documents **DO NOT CONSTITUTE AN ACCEPTABLE OR VALID REQUEST FOR SUBSTITUTION, NOR DO THEY CONSTITUTE APPROVAL.**

PART 3 - EXECUTION

Not Applicable.

END OF SECTION 01631

SECTION 01720

FIELD ENGINEERING

PART 1 - GENERAL

1.01 SUMMARY

- A. General: This Section specifies administrative and procedural requirements for field engineering services, including, but not limited to, the following:
 - 1. Land survey work.
 - 2. Civil engineering services.
- B. Related Sections:
 - 1. Section 01310 "Project Coordination."
 - 2. Section 01330 "Submittals."
 - 3. Section 01770 "Contract Closeout."

1.02 SUBMITTALS

- A. Certificates: Submit a certificate signed by the land surveyor or professional engineer certifying the location and elevation of improvements.
- B. Project Record Documents: Submit a record of Work performed and record survey data required under provisions of Section 01330 "Submittals" and Section 01770 "Contract Closeout".

1.03 QUALITY ASSURANCE

- A. Surveyor Qualifications: Engage a land surveyor registered in the State of North Carolina, to perform required land surveying services.
- B. Engineer Qualifications: Engage an engineer of the discipline required, registered in the State of North Carolina, to perform required engineering services.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Identification: The Contractor accepts existing control points and property line corner stakes and will restake if needed to perform the work.
- B. Verify layout information shown on the Drawings, in relation to the property survey and existing benchmarks, before proceeding to lay out the Work. Locate and protect existing property corners, benchmarks and control points. Preserve permanent reference points during construction.
 - 1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points or requirements to relocate reference points because of necessary changes in grades or locations.
 - 2. Promptly replace lost or destroyed Project control points. Base replacements on the original survey control points.
- C. Establish and maintain a minimum of 2 permanent benchmarks on the site, referenced to data established by survey control points.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
- D. Existing Utilities and Equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction.
 - 1. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water service piping.

3.02 PERFORMANCE

- A. Work from lines and levels established by the property survey. Establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.
 - 1. Advise entities engaged in construction activities of marked lines and levels provided for their use.
 - 2. As construction proceeds, check every major element for line, level, and plumb.

- B. Surveyor's Log: Maintain a surveyor's log of control and other survey Work. Make this log available for reference.
 - 1. Record deviations from required lines and levels, and advise the Architect and Owner when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.
 - 2. On completion of foundation walls, major site improvements, and other Work requiring field engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- C. Site Improvements: Locate and lay out site improvements, including retaining walls, pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations.
- D. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels and control lines and levels required for mechanical and electrical work.
- E. Existing Utilities: Furnish information necessary to adjust, move, or relocate existing structures, utility poles, lines, services or other appurtenances located in or affected by construction. Coordinate with local authorities having jurisdiction.

END OF SECTION 01720

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SECTION 01731

CUTTING AND PATCHING

PART 1 - GENERAL

1.01 SUMMARY

- A. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - 1. Requirements of this Section apply to mechanical and electrical installations. Refer to Division 15 and Division 16 Sections and Drawings for other requirements and limitations applicable to cutting and patching mechanical, plumbing, fire protection, and electrical installations.

1.02 SUBMITTALS

- A. General: Comply with Section 01330 "Submittals" and as specified herein.
- B. Cutting and Patching Proposal: Submit a proposal describing procedures well in advance of the time cutting and patching will be performed if the Architect or Owner requires approval of these procedures before proceeding. Include the following information, as applicable, in the proposal:
 - 1. Describe the extent of cutting and patching required. Show how it will be performed and indicate why it cannot be avoided.
 - 2. Describe anticipated results in terms of changes to existing construction. Include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
 - 3. List products to be used and firms or entities that will perform Work.
 - 4. Indicate dates when cutting and patching will be performed.
 - 5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
 - 6. Where cutting and patching involves added reinforcement to structural elements, submit details and engineering calculations showing reinforcement with the original structure.
 - 7. Approval by the Architect or Owner to proceed with cutting and patching does not waive the Architect's or Owner's right to later require complete removal and replacement of unsatisfactory Work.

1.03 QUALITY ASSURANCE

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load deflection ratio.
 - 1. Obtain the Architect's approval of the cutting and patching proposal before cutting and patching the following structural elements:
 - a. Foundation construction.
 - b. Structural concrete.
 - c. Structural steel.
 - d. Lintels.
 - e. Structural decking.
 - f. Miscellaneous structural metals.
 - g. Equipment supports.
 - h. Piping, ductwork, and equipment.
- B. Operational Limitations: Do not cut and patch operating elements or related components that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.
 - 1. Obtain Architect's or Owner's approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
 - a. Primary operational systems and equipment.
 - b. Air or smoke barriers.
 - c. Water, moisture, or vapor barriers.
 - d. Membranes and flashings.
 - e. Fire protection systems.
 - f. Noise and vibration control elements and systems.
 - g. Control systems.
 - h. Communications systems.
 - i. Electrical wiring systems.
- C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect's or Owner's opinion, reduce the building's aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction cut and patched in a visually unsatisfactory manner at sole opinion of the Architect or Owner.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

- A. Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible if identical materials are unavailable or cannot be used. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed before proceeding. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.
 - 1. Before proceeding, meet at the Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.02 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
 - 1. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
 - 2. Avoid cutting existing pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until provisions have been made to bypass them.

3.03 PERFORMANCE

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
 - 1. Cut existing construction to provide for the installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining construction. Where possible, review procedures with the original Installer; comply with the original Installer's recommendations.
 - 1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Cut through concrete and masonry using a cutting machine such as a Carborundum saw or diamond core drill.
 - 4. Comply with requirements of applicable Division 2 Sections where cutting and patching requires excavating and backfilling.
 - 5. Where services are required to be removed, relocated, or abandoned, by-pass utility services, such as pipe or conduit, before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
- C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
 - 1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
 - 2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

3. Where removing walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing the patch, after the patched area has received primer and second coat.
4. Patch, repair, or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

3.04 CLEANING

- A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, stains from sawcut water/slurry, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

END OF SECTION 01731

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SECTION 01770

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Project record document submittal.
 - 3. Operating and maintenance manual submittal.
 - 4. Submittal of warranties.
 - 5. Final cleaning.
- B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 16.
- C. Related Sections:
 - 1. Section 01771 "Project Record Documents" and Contract Documents.

1.02 PROJECT COMPLETION

- A. Preliminary Procedure: Before requesting completion inspection by the Architect and Owner, complete the following. List exceptions in the request.
 - 1. In the Application for Payment that coincides with, or first follows, the date of Certificate of Occupancy, show 100 percent completion for the portion of the Work claimed as substantially complete.
 - a. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 - b. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
 - 2. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
 - 3. Advise the Owner of pending insurance changeover requirements.
 - 4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

5. Submit record drawings, maintenance manuals, final project photographs, damage or settlement surveys, property survey, and similar final record information.
 6. Deliver tools, spare parts, extra stock, and similar items.
 7. Coordinate final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.
 8. Complete startup testing of systems and instruction of the Owner's operation and maintenance personnel. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements.
 9. Complete final clean up requirements, including touchup painting.
 10. Touchup and otherwise repair and restore marred exposed finishes.
- B. Inspection Procedures: On receipt of a request for inspection, the Owner will either proceed with inspection or advise the Contractor of unfilled requirements. The Owner will advise the Contractor of construction that must be completed or corrected before acceptance.
1. The Owner will repeat inspection when requested and assured that the Work is acceptably (satisfactorily) completed.
 2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.03 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for final acceptance and final payment, complete the following; list exceptions in the request.
1. Submit the final payment request with final releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required.
 - a. Include a final current and updated special inspection log, with a letter certifying that all special inspections required by governing Code have been performed.
 2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
 3. Submit a copy of the Architect's and Owner's final inspection list of items to be completed or corrected. The copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Certificate of Occupancy, or when the Owner took possession of and assumed responsibility for corresponding elements of the Work.
 5. Submit consent of surety to final payment (if applicable).
 6. Submit a final liquidated damages settlement statement.
 7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Reinspection Procedure: The Architect and/or Owner will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed because of circumstances acceptable to the Architect and Owner.
1. Upon completion of reinspection, if the Work is incomplete, the Owner will advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
 2. If necessary, reinspection will be repeated. The Contractor is responsible for the cost of reinspection, including time and travel.

1.04 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure fire-resistive location. Provide access to record documents for the Architect's and Owner's reference during normal working hours.
- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work.
 2. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.
 3. Note related change order numbers where applicable.
 4. Organize record drawing sheets into manageable sets. Bind with durable paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.

5. Record Drawings and Shop Drawings: On a complete set of prints, legibly mark each item to record actual construction including:
 - a. Measured depths of foundations in relation to finish first floor datum.
 - b. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - c. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - d. Field changes of dimension and detail.
 - e. Details not on original Contract drawings.
- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda. Include with the Project Manual one copy of other written construction documents, such as Change Orders and modifications issued in printed form during construction.
 1. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.
 2. Give particular attention to substitutions and selection of options and information on concealed construction that cannot be readily discerned later by direct observation.
 3. Note related record drawing information and Product Data.
 4. Upon completion of the Work, submit three record Specifications sets to the Owner.
- D. Record Product Data: Maintain one copy of each Product Data submittal. Note related Change Orders and markup or record drawings and Specifications.
 1. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site and from the manufacturer's installation instructions and recommendations.
 2. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation.
 3. Upon completion of markup, submit three complete sets of record Product Data to the Owner.
- E. Record Samples Submitted: Immediately prior to Project completion, the Contractor shall meet with the Owner's personnel at the Project Site to determine which Samples are to be transmitted to the Owner for record purposes. Comply with the Owner's instructions regarding delivery to the

Owner.

- F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Prior to Project completion, complete miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to the Architect and the Owner.

1.05 OPERATION AND MAINTENANCE MANUALS

- A. Prepare instructions and data by personnel experienced in maintenance and operation or described products.
- B. Prepare data in the form of an instructional manual.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 3 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
 - 1. In addition to required number of binders to be submitted, provide an equal number of electronic copies on disk.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.
- F. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
- G. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. List of equipment.
 - b. Parts list for each component.
 - c. Operating instructions.

- d. Maintenance instructions for equipment and systems.
- 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
 - b. Original and photocopies of warranties and bonds.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.01 CLOSEOUT PROCEDURES

- A. Operation and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Provide three (3) copies of operation and maintenance instructions as paper copy and electronic copy. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:
 - 1. Maintenance manuals.
 - 2. Record documents.
 - 3. Spare parts and materials.
 - 4. Tools.
 - 5. Lubricants.
 - 6. Fuels.
 - 7. Identification systems.
 - 8. Control sequences.
 - 9. Hazards.
 - 10. Cleaning.
 - 11. Warranties and bonds.
 - 12. Maintenance agreements and similar continuing commitments.
- B. As part of instruction for operating equipment, demonstrate the following procedures:
 - 1. Startup.
 - 2. Shutdown.
 - 3. Emergency operations.
 - 4. Noise and vibration adjustments.
 - 5. Safety procedures.
 - 6. Economy and efficiency adjustments.

7. Effective energy utilization.

3.02 FINAL CLEANING

- A. General: The General Conditions require general cleaning during construction. Regular site cleaning is included in Section 01500 "Construction Facilities and Temporary Controls." Coordinate with final cleaning requirements in Section 01772 "Final Cleaning."
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
 - 1. Complete the following cleaning operations before turnover for Owner occupancy:
 - a. Remove labels that are not permanent labels.
 - b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
 - c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original condition. Power scrub concrete floors clean. Vacuum carpeted surfaces.
 - d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
 - e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Power sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection, and rid the Project of rodents, insects, and other pests.
- D. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

- E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.
 - 1. Where extra materials of value remaining after completion of associated Work, they become the Owner's property. Dispose of these materials as directed by the Owner.

END OF SECTION 01770

SECTION 01771

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 SCOPE

- A. This Section outlines procedures to follow and supplements Paragraph 3.11 of the General Conditions of the Contract for Construction, Fifteenth Edition, AIA Document A201, 2007.

1.02 REQUIREMENTS INCLUDED

- A. Maintain at Project Site for Owner, one record copy of:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to Contract.
 - 5. Field Orders or written instructions.
 - 6. Approved Shop Drawings, Product Data and Samples.
 - 7. Field Test records.
- B. Make Record Documents available to Architect and Owner.
 - 1. Advise, on current basis, of all changes in the work made during construction.

1.03 RECORD DOCUMENTS

- A. Field Record Drawings: Three designated, complete sets of drawings upon which all changes to work are duly recorded on daily, continuing basis to provide accurate, factual information relative to work as constructed, both visible and concealed.
 - 1. In form of direct line prints provided by Architect prior to commencement of work, with each sheet bearing rubber stamp impression reading "Record Drawings".
- B. Final Record Drawings: Three complete sets of reproducible sepia transparencies and CADD Files, in AutoCad Release 12 or later version, and a PDF copy, upon which all changes to work are duly transferred from Field Record Drawings to enable future additions, alterations and modifications to proceed without necessity of making extensive field measurements, exploratory investigations and examinations.

1. In form of sepia transparencies and CADD disks (PDF format), provided by Architect upon request at time near completion of work.
- C. Field Record Specifications: One designated, complete set of Specifications within which changes to materials, products, equipment, and systems are duly recorded.
 1. Complete set of Specifications, provided by Architect, in one or more volumes, marked "Record Specifications" on outside back binding and an electronic copy.

1.04 QUALITY ASSURANCE

- A. Assign responsibility for maintaining Field Record Documents to one individual having previous experience in posting and maintaining Record Documents.
 1. Coordinate entries into Field Record Documents with proper markings on each sheet of Drawings and each page of Specifications, as appropriate, where such is required to properly record work as constructed.
 2. Make entries upon Field Record Documents within 24 hours after receipt of information except note dimensional corrections and new dimensional data immediately upon determination.
- B. Prior to submittal of monthly Application for Payment, request Owner to review current status of Field Record Documents.
 1. Failure to maintain Field Record Documents in up-to-date condition may be considered justifiable reason for withholding payment until documents are properly updated.

1.05 HANDLING AND STORAGE

- A. Provide safe, secure storage space for Field Record Documents.
- B. Protect Field Record Documents against loss, damage and deterioration until such time work is complete and recorded data is transferred to Final Record Documents.
- C. Do not permit Field Record Documents to be used for any purpose other than entry of record information.

1.06 ENTRIES ON DRAWINGS

- A. Make entries on Field Record Drawings with erasable colored pencil to clearly describe changes, deviations and corrections by notes and graphic lines as required. Identify entry by “cloud” type circle around affected work. Initial and date each entry.
 - 1. In event of overlapping entries, different colors may be used to differentiate between entries.
- B. Update Field Record Drawings within specified time limits to maintain accurate record of work as constructed, including:
 - 1. Horizontal location and vertical elevation of underground and buried portions of work.
 - 2. Location, size and arrangement of concealed mechanical and electrical portions of work, including conduit, piping, valves, ductwork, outlets, and equipment.
 - 3. Location, size and arrangement of exposed mechanical and electrical portions of work.
 - 4. Changes and corrections to dimensions.
 - 5. Changes to materials, products, equipment and finishes.
 - 6. Changes and deviations in work from that indicated in Contract Documents.
- C. Make field measurements of in-place work and enter proper dimensions on Field Record Drawings. Establish locations by two or more dimensions to permanent reference points.
 - 1. Identify equipment, valves, piping, conduit, fixtures and devices using symbols and designations corresponding to those used in Contract Documents.

1.07 ENTRIES IN SPECIFICATIONS

- A. Make entries in Field Record Specifications with erasable colored pencil to clearly describe actual products, materials, equipment and systems incorporate into the work, and to describe changes, deviations and corrections. Initial and date each entry.
 - 1. Where products of more than one manufacturer are named in Specifications, properly mark to clearly identify which products are incorporated into work.

1.08 ENTRIES IN FINAL RECORD DOCUMENTS

- A. Upon receipt of final sepia transparencies, and prior to start of transfer of recorded data onto sepia transparencies, request review of Field Record Documents by Architect and Owner.
- B. Carefully transfer recorded data shown on Field Record Drawings to corresponding sepia transparencies and CADD disks, provided by Architect. Make and identify entries in same manner as used on Field Record Drawings except use ink or crisp black pencil in lieu of colored pencil.
- C. If Field Record Specifications have been kept reasonably clean and if entries have been kept sufficiently in order, no further copies will be required.
 - 1. If Field Record Specifications are not in proper condition, obtain new copy of Specifications from Architect, at normal costs for reproduction, and transfer recorded data into new copy.

1.09 REVIEW AND ACCEPTANCE

- A. Upon completion of transfer of recorded data to Final Record Documents, submit total for Architect's and Owner's review. Participate in review meetings as may be required.
- B. Make all required corrections and changes in Record Documents and promptly deliver completed Record Documents for Architect's final review and transfer to Owner for his final records.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

Not Applicable.

END OF SECTION 01771

SECTION 01772

FINAL CLEANING

PART 1 - GENERAL

1.01 SCOPE

- A. This Section outlines periodic and final clean up procedures and supplements provisions of Paragraphs 3.15 and 6.3 of the General Conditions of the Contract for Construction, Fifteenth Edition, AIA Document A201, 2007.
- B. In addition to procedures outlined herein, refer to individual Specifications Sections for detailed cleaning requirements. Coordinate with final cleaning requirements in Section 01770 "Contract Closeout."
- C. If Contractor fails to keep project clean or to clean up prior to date of Certificate of Occupancy, Owner may, at Contractor's expense, do so as provided in Paragraph 3.15.2 of General Conditions.

1.02 DISPOSAL REQUIREMENTS

- A. Remove and dispose of waste materials, rubbish, debris and trash in compliance with provisions of governing laws, codes, ordinances and regulations.
 - 1. Unless otherwise approved by the Owner, do not burn or bury rubbish, trash, debris and waste materials on Project site.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Provide cleaning products to suit individual cleaning needs for materials, equipment and surfaces to be cleaned, and meeting the following general requirements:
 - 1. Product, or products, do not create hazards to health.
 - 2. Will not scratch, mar, stain, discolor or otherwise damage work or any portion thereof.
 - 3. Are recommended by manufacturer of surface material to be cleaned.

- B. Provide scrubbers, brooms, rakes, vacuum cleaners, tools, equipment, buckets, pails, clean cloths and incidentals necessary for proper application and removal of cleaning materials and for execution of interior and exterior clean up operations.

PART 3 - EXECUTION

3.01 PERIODIC CLEANING

- A. On regular and frequent basis during progress of work, perform cleaning necessary to keep work, Project site and adjacent properties free from unsightly and unsafe accumulation of scrap and waste materials, debris, rubbish and trash resulting from construction operations.
 - 1. Provide sufficient trash bins and containers for collection of scrap and waste material, debris, rubbish and trash.
 - 2. Provide separate, closable top metal containers for collection of oil and paint soaked rags; empty volatile substance cans and other waste products subject to spontaneous combustion.
 - 3. Provide covered containers conforming to local health codes for collection of waste paper and left-over foodstuffs. Enforce usage of containers by workmen.
- B. Dispose of scrap and waste materials, debris, rubbish and trash by one of following options methods:
 - 1. Provide services of company regularly engaged in refuse disposal operations, including usage of large metal dump-type trash containers.
 - 2. Use own forces and equipment for loading, hauling and disposal.
- C. Remove accumulations of scrap and waste materials as bins and containers are filled and not less than once per week.
 - 1. Remove containers containing products subject to spontaneous combustion daily.
 - 2. Remove containers containing waste paper and left-over foodstuff daily.
 - 3. Legally dispose of all waste materials, rubbish, volatile materials and cleaning materials off Project site. Do not pour volatile, harmful, or dangerous materials into drainage systems.
 - 4. Dispose of no materials in waterways or adjacent properties.

3.02 DUST CONTROL

- A. During application of finished surface materials, including painting and decorating, employ dust control methods during cleaning operations to prevent dust from contaminating wet and freshly coated surfaces.
- B. Provide overall dust control for the entire Project, in compliance with requirements of governing authorities. The Contractor is responsible for all damages to neighboring properties due to inadequate dust control measures.

3.03 FINAL CLEANING

- A. Immediately prior to Completion of Work perform cleaning of all visually exposed materials, fixtures, equipment and finished surfaces.
- B. Remove manufacturer's labels, tags, stickers and unauthorized identification markings from finished surfaces.
 - 1. Do not remove permanently affixed nameplates, instructions, markings, Underwriters Laboratories labels and approval stickers, Factory Mutual approval stickers and other identifying markings required by federal, state and local codes, ordinances and regulations.
- C. Remove broken, chipped and defective glass; remove stains, spots, marks, paint smears; dirt and foreign materials; clean and polish exterior and interior glass; clean and polish mirrors.
- D. Remove temporary protective coatings, tapes and films from finished surfaces and metal surfaces, clean and polish surfaces and metal in compliance with manufacturer's instructions.
- E. Remove paint smears, spots, marks, dirt, mud and dust from exposed interior and exterior finished surfaces. Clean interior surfaces of tilt wall panels to remove dust and surface dirt. Wipe down or pressure wash. Completely remove dust from ceiling areas (i.e. bar joists, piping, and beams).
- F. Clean and polish finished hardware; remove marks, stains, paint, scratches and blemishes.

- G. Power sweep and wet scrub concrete floors not less than broom clean; vacuum where necessary to remove excessive dust; thoroughly clean other hard surfaced floors.
 - 1. Remove mortar droppings, joint compound, plaster and cementitious material droppings from floors prior to final cleaning.
- H. Remove all construction debris from roof areas.
- I. Remove all construction debris from the site. Pick up all trash on a daily basis.
- J. Sweep exterior paved surfaces broom clean; rake clean unpaved surfaces. Wash down if needed to remove soil and debris.
- K. Thoroughly clean all items of mechanical and electrical equipment; remove excess oils and grease from exposed surfaces.
 - 1. Clean permanent filters and replace disposable filters if ventilating units were operated during construction.
 - 2. Clean ducts, blowers and coils if units were operated without filters during construction.
 - 3. Clean and sanitize all plumbing fixtures.
- L. Complete the following cleaning operations three days prior to occupancy by the Owner. Incomplete work may be performed by the Owner.
 - 1. Warehouse Area:
 - a. Wipe down and clean all surfaces including all walls, electrical and mechanical equipment, conduits, lighting fixtures, ductwork, steel joists, and piping.
 - b. Power sweep and wet mop concrete floor.
 - 2. Toilet Rooms:
 - a. Wipe down and clean all surfaces including walls, mirrors, entry doors, countertops, and partitions.
 - b. Wipe down and clean light fixture lenses.
 - c. Sweep and wet mop floors.
 - d. Clean and sanitize all plumbing fixtures.

3. Janitors Closet:
 - a. Wipe down and clean all surfaces including walls, piping, light fixtures, shelving, and entry door.
 - b. Clean and sanitize the mop sink.
 - c. Sweep and wet mop the concrete floor.
4. Building Exterior:
 - a. Wipe down and clean all framing/trim and doors.
 - b. Remove all soil, stains, and discoloration from walls and sills.
 - c. Remove all dust and dirt from underside of the canopy(s).
5. Roof:
 - a. Remove all debris from the roof.
 - b. Broom clean roof surfaces.
 - c. Pressure wash and remove all soils and stains from membrane and flashings.
6. Site:
 - a. Remove all rubbish, waste materials, litter, and other debris from the parking lot and site area.
 - b. Power sweep all paved areas. Wash paved areas to remove remaining soil. Clean spills, stains, and other foreign deposits from paved areas.
 - c. Remove all tools, construction equipment, machinery, and surplus materials from the site. Tools, equipment, machinery, and materials in use shall be stored in a single area designated by the Owner's Representative.
 - d. Remove all soil, stains, and foreign debris from sidewalks, and curbs. Pressure wash if needed.
 - e. Flush all storm drain lines, removing silt and debris, and clean inlet structures.
7. Buildings and Site: Ream all sanitary sewer lines.

M. In the sole opinion of the Owner, the Owner will supplement the General Contractor's cleaning forces as needed to comply with these standards and the Project schedule. The incurred cost will be the responsibility of the General Contractor and be deducted from the Contract.

3.04 FINAL INSPECTION

- A. As the work nears completion, the General Contractor shall review the requirements of the Contract Documents, inspect the work, and inform all parties involved of work to be corrected or completed before the project can be deemed substantially complete.
- B. Upon Completion, The Owner's Representative will perform an inspection.

- C. The Owner's Representative reserves the right to cancel and reschedule the inspection in the event considerably more work remains to be completed or corrected than indicated on the written request for inspection.
- D. A representative of the General Contractor shall be present at the time of inspection.
- E. Separate/individual punchlists will be performed by the following parties:
 - 1. The Owner's Construction Manager.
 - 2. The Architect, Structural, and/or the MEP and Fire Protection engineering consultants.
 - 3. The independent testing and inspection company (ITC).
 - 4. The Owner's Facility Manager.
 - 5. The independent HVAC test and balance company.
 - 6. The Civil Engineer.
 - 7. The Landscape Architect.
 - 8. An independent fire protection inspection company.
 - 9. Roofing manufacturer.
 - 10. Other specialty professionals as deemed necessary.

The punchlist will be issued to the General Contractor upon performance of the specific inspection. Punchlist is partial or preliminary until all work has been completed. A final punch cannot be performed on portions of work that are incomplete.

END OF SECTION 01772

SECTION 01780

WARRANTIES

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturers' standard warranties on products and special warranties.
 - 1. Refer to the General Conditions for terms of the Contractor's period for correction of the Work.
- B. Related Sections:
 - 1. Section 01330 "Submittals."
 - 2. Section 01770 "Contract Closeout."
 - 3. Divisions 2 through 16 Sections for specific requirements and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
 - 4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
- C. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.02 DEFINITIONS

- A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.03 WARRANTY REQUIREMENTS

- A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and has been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: On determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through part of its anticipated useful service life.
- D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties, and shall not limit duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
 - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- E. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.04 SUBMITTALS

- A. Submit written warranties, **ON FORMS PROVIDED AT THE END OF THIS SECTION**, to the Owner within 30 days of Certificate of Occupancy. **THE COMMENCEMENT DATE FOR WARRANTIES SHALL BE THE DATE OF CERTIFICATE OF OCCUPANCY.**
 - 1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Owner within 15 days of completion of that designated portion of the Work.

- B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner for approval prior to final execution.
- C. Forms for special warranties are included at the end of this Section. Prepare a written document utilizing the appropriate form, ready for execution by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Submit a draft to the Owner for approval to final execution.
 - 1. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.
- D. Forms of Submittal: within 30 days following Certificate of Occupancy compile and submit 3 copies of each required warranty properly executed by the Contractor, or by the subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- E. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2 inch by 11 inch paper.
 - 1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.
 - 2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES", Project title or name, and name of the Contractor.
 - 3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

Not Applicable.

END OF SECTION 01780

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SECTION 01781

CONTRACTOR WARRANTY FORM

PROJECT:

LOCATION:

OWNER:

We _____
(Company Name)

Contractor for the above-referenced project, hereby warrants that all labor and materials furnished and work performed is in compliance with Contract Documents and authorized modifications thereto, and will be free from defects due to defective materials or workmanship for a period of the latter of one year from the Date of Certificate of Occupancy or expiration of Subcontractor's warranty.

This warranty comments on

(Date of Certificate of Occupancy)

Should any defect develop during warranty period due to improper materials, workmanship or arrangement, the same, including adjacent work displaced, shall be made good by undersigned at no expense to Owner.

The Owner will give Contractor written notice of defective work. Should Contractor fail to correct defective work within 5 days after receiving written notice, Owner may, at his option, correct defects and charge Contractor costs for such correction. Contractor agrees to pay such charges.

FOR: _____
(Company Name)

BY: _____

TITLE: _____

DATE: _____

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SECTION 01782

SUBCONTRACTOR WARRANTY FORM

PROJECT:

LOCATION:

OWNER:

GENERAL CONTRACTOR:

We _____
(Company Name)
Subcontractor for _____, as described in Specified
(List Trade)
Sections _____
(List appropriate sections of Specifications)

do hereby warrant that all labor and materials furnished and work performed in conjunction with the above-referenced project are in compliance with Contract Documents and authorized modifications thereto, and will be free from defects due to defective materials or workmanship for a period of _____year(s) from the Date of Certificate of Occupancy.

This warranty commences on

(Date of Certificate of Occupancy)

and expires on

(Expiration Date)

Should any defect develop during warranty period due to improper materials, workmanship or arrangement, the same, including adjacent work displaced, shall be made good by undersigned at no expense to Owner.

The Owner will give Subcontractor written notice of defective work. Should Subcontractor fail to correct defective work within 5 days after receiving written notice, Owner may, at his option, correct defects and charge Subcontractor costs for such correction. Subcontractor agrees to pay such charges.

FOR: _____ FOR:

(General Contractor)

(Company Name)

BY: _____ BY:

TITLE: _____ TITLE:

DATE: _____ DATE:

SECTION 02011 TESTING

1. GENERAL

- (A) Include all labor, material and equipment to perform all work in this Section.
- (B) The GC shall be responsible for providing a copy of Division 1 specifications to each Subcontractor and for coordinating the work accordingly.
- (C) Submittal data, shop drawings, and samples:
 - (1) Shall be submitted for review only when required by and in accordance with the procedure set forth in Division 1 Section 01330 "Submittals" specifications.
 - (2) All references to submittal data, shop drawings, and samples in the context of the technical specifications shall be taken to mean "if required under the provisions of Division 1 Section 01330 "Submittals, unless stipulated otherwise.
- (D) Refer to Section Division 1 Section 01400 "Quality Control Services" for requirements relating to Base Bid Products, Alternates, and Substitutions.
- (E) The Owner will employ and pay for the services of an independent testing agency to provide testing and inspection of soil placement and compaction, concrete and asphalt paving work, roofing, steel erection and curtain wall work. The Contractor shall schedule and coordinate his work with the testing agency.
- (F) The testing agency shall be selected by the Owner prior to beginning work. The testing agency shall be licensed in the state where the structure is located. All testing and inspections shall be performed under the supervision of an engineer registered in the state where the structure is located.
- (G) At the completion of all concrete work the testing agency shall submit a letter of certification stating that all work has been constructed, tested and inspected in accordance with the contract documents and all applicable code requirements.
- (H) The Owner may elect to change testing agencies at his own discretion.
- (I) Invoices for testing work shall be made to the Owner. Testing agency personnel shall have their time sheets signed by an authorized representative of the General Contractor. Copies of signed time sheets must be submitted with all invoices for payment.

2. WORK INCLUDED

- (A) Testing of compaction throughout site for compliance with these specifications.
- (B) Inspection and approval of subgrade prior to placement of all soil fill, footings, foundations, drainage structures, utilities, slabs and pavements. All footing subgrades shall meet the design bearing capacity criteria as outlined in the Soils Report.
- (C) Testing of all excavation and backfill compaction including that for plumbing, mechanical, electrical, utility, stormwater and foundation drainage trenches shall comply with these specifications.
- (D) Off-site fill must be approved by testing agency prior to placement.
- (E) Inspection and testing of all grading operations for compliance with these specifications.
- (F) Inspection and testing of all site drainage work for compliance with these specifications.
- (G) Inspection and testing of concrete, asphaltic concrete and pavement base materials, installation, and compaction. Refer to Specification Sections 02511 "Asphalt Paving" & 02520 "Portland Cement Concrete Paving" for paving and base criteria.
- (H) Inspection and testing of water utility construction. Refer to Specification Sections 02668 "Water Piping" for testing criteria.
- (I) Inspection and testing of structural steel & curtain wall erection and roofing.

3. COMPACTION TEST REQUIREMENTS

- (A) Compaction test shall include but not be limited to site inspections with one density test per 5,000 sq. ft. of area per lift in the building area and one density test for every 7500 sq. ft. of area per lift in the pavement area. The frequency of testing is subject to adjustment by the Civil Engineer, Architect, or Owner.
 - (1) Said inspections shall be pre-scheduled.

- (2) A report shall be submitted, following each inspection, and prior to next inspection, that shall include observations, recommendations and test results.

4. REPORTING

- (A) Reports shall be distributed to the General Contractor, the Civil Engineer, the Architect and the Owner. The field supervisor shall be notified immediately of results.
- (B) All field reports and test reports shall be signed and sealed by a licensed engineer in the state where the structure is located.
- (C) Records of inspection shall be kept available to the Owner during progress of work for two years after completion of the project. Records shall be preserved by the independent testing agency.
- (D) Distribute electronic reports to the General Contractor, the Civil Engineer, the Architect and the Owner within 48 hours of testing.

- END OF SECTION -

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SECTION 02050 DEMOLITION

1. GENERAL

- (A) Include all labor, material and equipment necessary for and incidental to the execution of all demolition and removal work within the limits established on the plans.
- (B) Visit the site and examine all conditions that may affect the scope of work required under this Section.
- (C) Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. All demolition shall comply with OSHA requirements.

2. UTILITIES

- (A) Preserve in operating condition all active utilities traversing the site. Protect all property, including but not limited to; mains, manholes, catch basins, valve boxes, poles, guys and other appurtenances (as applicable). Repair damage to any such utility due to work under this contract.
- (B) Contact the local underground utility locator prior to beginning work.

3. DEMOLITION AND REMOVAL

- (A) Demolish and remove existing buildings, foundations, steps, porches, posts, driveways, walks curbs, fencing, utilities, drainage, site walls and pavement as shown on the plans, and/or as specified herein.
- (B) Remove all rubbish, trash & debris from the site.
- (C) Provide protection to persons and property. Execute the work so as to avoid interference with the use of adjoining facilities.
- (D) All demolished work, unless otherwise noted, shall become the property of the Contractor and shall be removed from the site. All debris caused by demolition and all existing debris (above ground and discovered below ground), shall be cleared and removed from the site. No filling of excavations with materials from demolition will be permitted. Do not allow material and debris to accumulate on site. Burning will not be allowed.
- (E) Contractor shall not reuse existing materials unless specifically noted in contract agreement.

- END OF SECTION -

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SECTION 02160
EXCAVATION SUPPORT SYSTEMS

A. General

1. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. All shoring shall comply with OSHA requirements.
2. Summary
 - a. This Section includes, but is not limited to, the following:
 - (1) Shoring and bracing necessary to protect existing buildings, streets, walkways, utilities, wetlands and other improvements and excavation against loss of ground or caving embankments.
 - (2) Maintenance of shoring and bracing.
 - (3) Removal of shoring and bracing, as required.
 - b. Types of shoring and bracing systems include, but are not limited to, the following:
 - (1) Steel H-section (soldier) piles.
 - (2) Timber lagging.
 - (3) Steel sheet piles.
 - c. Excavation is specified in Excavation and Grading Section 32 1120 .
3. Submittals
 - a. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
 - b. Layout drawings for excavation support system and other data prepared by, or under the supervision of, a qualified Professional Engineer. System design and calculations must be acceptable to local authorities having jurisdiction.
4. Quality Assurance
 - a. Engineer Qualifications: A Professional Engineer legally authorized to practice in jurisdiction where Project is located, and experienced in providing engineering services for excavation support systems similar in extent required for this Project.
 - b. Supervision: Contractor shall engage and assign supervision of excavation support system to a qualified Professional Engineer.
 - c. Regulations: Comply with codes and ordinances of governing

authorities having jurisdiction.

5. Job Conditions

- a. Before starting work, verify governing dimensions and elevations. Verify condition of adjoining properties. Take photographs to record any existing settlement or cracking of structures, pavements, and other improvements. Prepare a list of such damages, verified by dated photographs, and signed by Contractor and others conducting investigation.
- b. Survey adjacent structures and improvements, employing qualified surveyor, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
- c. During excavation, resurvey benchmarks weekly, maintaining accurate log of surveyed elevations for comparison with original elevations. Promptly notify Civil Engineer, Architect, and Owner if changes in elevations occur or if cracks, sags, or other damage is evident.

6. Existing Utilities

- a. Protect existing active sewer, water, gas, electricity and other utility services and structures.
- b. Notify municipal agencies and service utility companies having jurisdiction. Comply with requirements of governing authorities and agencies for protection, relocation, removal, and discontinuing of services.

B. Products

1. Materials

- a. General: Provide adequate shoring and bracing materials which will support loads imposed. Materials need not be new, but should be in serviceable condition.
- b. Structural Steel: ASTM A 36.
- c. Steel Sheet Piles: ASTM A 328.
- d. Timber Lagging: Any species, rough-cut, mixed hardwood, nominal 3 inches thick, unless otherwise indicated on the approved layout drawings.

C. Execution

- 1. Shoring - Wherever shoring is required, locate the system to clear permanent construction and to permit forming and finishing of concrete surfaces. Provide shoring system adequately anchored and braced to resist

earth and hydrostatic pressures.

2. Bracing

Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move a brace, install new bracing prior to removal of original brace.

- b. Do not place bracing where it will be cast into or included in permanent concrete work, except as otherwise acceptable to Architect.
- c. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
- d. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.
- e. Remove sheeting, shoring, and bracing in stages to avoid disturbance to underlying soils and damage to structures, pavements, facilities, and utilities.
- f. Repair or replace, as acceptable to Civil Engineer, Architect, and Owner, adjacent work damaged or displaced through installation or removal of shoring and bracing work.

-END OF SECTION-

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SECTION 02211 EXCAVATION AND GRADING

1. GENERAL

- (A) Include all labor, material and equipment necessary for and incidental to the execution of all erosion control, clearing, grubbing, and grading work as shown on the plans.
- (B) Visit the site and examine all conditions that may affect the scope of work.
- (C) Maintain bench marks and other reference points. If disturbed or destroyed, replace as necessary. Maintain property corners and boundary markers. If disturbed or destroyed, replace as necessary.
- (D) Take necessary precautions to prevent blocking of sewers, filling of ditches and washing of earth onto existing pavement during heavy rains. After heavy rains promptly clean up any debris and sedimentation that may have occurred, or might be damaging to sewers, ditches, and pavements. Comply with all local ordinances relative to erosion control. Comply with requirements of the National Pollutant Discharge Elimination System (NPDES) and/or Water Pollution Prevention, as required. The General Contractor to comply with general and specific permit requirements (e.g. notifications, inspection/monitoring, recordkeeping/reporting, maintenance of all erosion control devices, etc.).
- (E) Topographic and property surveys giving lot size, ground elevations, obstructions on site, locations and depths of sewers, conduits, pipes, existing structures, curbs, pavements, tracts, and soil boring data giving the nature of ground and sub-surface conditions have been obtained from reliable sources. The accuracy of this data is not guaranteed, and is furnished solely as an accommodation to the Contractor. Use of this data shall be made at the Contractor's discretion. No additional compensation will be granted due to the Contractor's lack of knowledge of site conditions. Prior to bid submission, conduct any additional surveys and soils tests you may deem necessary to verify the accuracy of the information provided.
- (F) All site work is to be done in accordance with the plans and specification. The soils report is made available for the convenience of the Contractor. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn therefrom by Contractor. Additional test borings and other exploratory operations may be made by Contractor. for the purpose of preparing his bid but these will be at no cost to the Owner.
- (G) Contractor is responsible for estimating and calculating all cut and fill

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quantities. Prior to bid submission the Contractor shall conduct any additional surveys and soil tests he deems necessary to calculate the cut and fill quantities properly. Additional surveys and tests made by the Contractor shall be made at no cost to the Owner.

- (H) Contractor is responsible for restoring offsite areas disturbed in performance of the work.
- (I) Contractor to maintain clean access drives. Keep mud and construction debris onsite. Clean offsite roadways when needed.
- (J) Contractor to provide requested unit prices.

2. WORK INCLUDED

- (A) Erosion Control measures
- (B) Clearing and removal of debris.
- (C) Protection of trees.
- (D) Topsoil removal and stockpiling.
- (E) Grading, Earthwork
- (F) Proofrolling
- (G) Compaction.
- (H) Clean-up.

3. WORK SPECIFIED ELSEWHERE

- (A) Excavation Support Systems, Section 02160.
- (B) Excavation and backfill for Mechanical and Electrical trades.

4. QUALITY ASSURANCE

- (A) General
 - (1) The Owner will employ and pay for the services of an independent testing agency to provide testing and inspection of the site grading work. The testing agency shall be licensed in the state where the structure is located and all testing and inspections shall be performed under the supervision of an engineer registered in the state where the structure is located.

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- (2) Site grading work and materials shall be tested and inspected as the work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate the Owner's Representative for final acceptance.
 - (3) The testing agency shall report all test and inspection results to the Civil Engineer, Architect, Owner and Contractor immediately after they are performed. All test and inspection reports shall be signed and sealed by an engineer registered in the state where the structure is located and shall include the exact location of the work represented by the test.
 - (4) The testing agency and its representatives are not authorized to revoke, alter, relax, enlarge or release any requirement of the contract documents, approve or accept any portion of the work, perform any duties of the Contractor, or be a party to scheduling of work.
 - (5) The Contractor shall notify the testing agency a minimum of 24 hours in advance of all site grading work.
 - (6) Records of inspection shall be kept available to the building official during progress of work and for two (2) years after completion of the project. Records shall be preserved by the independent testing agency.
- (B) The testing agency shall conduct site grading inspections and testing as necessary to determine that:
- (1) All topsoil and organic matter have been removed from the building and paved areas.
 - (2) All grading and proofrolling have been performed per the specifications.
 - (3) Approval of all on-site and off-site fill materials.
 - (4) All fill materials have been compacted per the specifications.
5. EROSION CONTROL
- (A) Install and maintain during construction all erosion control measures as required by local ordinance and as specified on the drawings.
6. CLEARING AND REMOVAL OF DEBRIS

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- (A) All obstructions within the building, paving or planted areas shall be removed. Grub out roots of all trees and remove stumps.
- (B) Remove from site all trees, stumps, debris piles, or other refuse encountered during clearing and grading.
- (C) Refer to Section 02050, DEMOLITION, and Drawings for demolition work required.

7. PROTECTION OF TREES (as applicable)

- (A) All trees which are outside the limits of grading operations are to remain in place and be maintained, unless otherwise noted on the plans.

8. TOPSOIL REMOVAL & STOCKPILING

- (A) Remove all topsoil and organic matter from cut and fill areas before grading operations start.
- (B) Stockpile a sufficient amount of topsoil for later distribution in planted areas. All excess topsoil is to be removed from the site.
- (C) Before placing fill, remove all debris subject to termite attack, rot or corrosion, and all other deleterious materials from areas to be filled.
- (D) If, during the course of excavation work, unsuitable soil per the Soils Report is encountered, soil undercut volume (if any) will be measured in the ground (i.e. in place). Contract unit cost (if any) will be based upon the in-ground volume as measured by the Geotechnical Engineer and the Owner's representative.

9. GRADING

- (A) Prior to grading, set grade stakes to establish finish contours.
- (B) Perform grading to a tolerance of plus or minus 1 inch within building and paved areas.
- (C) Allow for the thicknesses of the floor slab and base material within building limits, for the pavement and its base in paved areas and for topsoil replacement in landscaped areas.
- (D) Unless otherwise indicated on the plans, grading shall be evenly sloped to provide drainage. Round top and bottom of banks and at other breaks in grade.
- (E) Provide suitable off-site fill material, or alternately, dispose of all excess

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material as required, to achieve the final grades shown on the plans.

10. ROCK EXCAVATION:

- (A) All excavation work shall be considered unclassified.
- (B) Should rock be encountered in the cut areas or in the trenches, use a backhoe or ripper until the use of such equipment is not practical.
- (C) Remove all rock if encountered, at no additional cost to Owner.
- (D) Remove rock to depths designated on plans below slabs, footings, and pavement, and below areas to receive lawns and planting.
- (E) When blasting is required, such work shall be conducted only by firms who are specialized and are licensed to do this work and have adequate insurance coverage.

11. PROOFROLLING

- (A) After clearing, grubbing and organic topsoil removal all areas at or below final subgrade shall be proofrolled with a loaded tandem axle dump truck (minimum loaded weight of at least 20 tons), scraper or other similar, pneumatic-tired piece of construction equipment in the presence of the Geotechnical Engineer.
- (B) Soft, organic, highly plastic, or excessively wet soils or old fill materials encountered during the proofrolling operation, causing deflection or not acceptable by the Geotechnical Engineer, shall be excavated and replaced with clean fill or material specified by the Geotechnical Engineer in the field to facilitate compaction at no extra cost under the base contract.

12. COMPACTION

- (A) Suitable on-site materials may be used as fill. All fill shall consist of clean material which is free of roots and debris. Refer to Soils Report.
- (B) Off-site borrow material must be approved by the independent testing agency. Approval will be based upon the results of tests conducted by a qualified soils testing laboratory.
- (C) Fill within building lines and under paved areas shall be placed in loose horizontal layers not more than eight inches (8") thick. Interim grade shall always be kept sloped and crowned to facilitate run-off. Place no fill on frozen or on excessively wet or dry subgrade.
- (D) The bottom of all trenches, and the soil under areas where underground

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structures are to be constructed and/or installed, shall be compacted to a minimum of 98% of the Standard Proctor maximum dry density, per ASTM D-698 prior to pipe and structure installation. All fill material placed adjacent to and above piping and structures shall be placed in eight (8) inch layers and shall be compacted to 98% per ASTM D-698.

- (E) Fill the upper eighteen (18) inches under building slabs & paved areas shall be compacted to 98% of the Standard Proctor maximum dry density (ASTM D-698).
- (F) Continuous wall footing trenches and individual footing pits shall be excavated to footing line and bottom grade. Foundation soils shall be compacted with suitable mechanical equipment to achieve the specified level of density to the required depth. Foundation bottom grade shall be tested to confirm that a minimum density of 98% of the Standard Proctor maximum dry density exists to a depth of 24 inches below footing bottom adequate foundation bearing condition are present prior to the placement of concrete. Dynamic Cone Penetrometer tests (ASTM 399) shall be used for verification, as determined by the project geotechnical engineer.
- (G) Contractor shall protect and maintain all finished compacted areas. Any finished compacted subgrade area which deflects one inch (1") or more as a result of construction traffic shall be cut, disced, and recompact or stabilized. The depth of the cut, discing procedure, compaction or stabilization requirements shall be determined by the Geotechnical Engineer in the field. There shall be no extra cost under the base contract for this subgrade recompaction or stabilization.
- (H) The Contractor is responsible for wetting, drying, dewatering, and moisture control for subgrade soils.
- (I) All fill material shall be free of debris and fibrous organic material.
- (J) To ensure workability with a minimum compactive effort, it is essential that the material be kept at or near the optimum moisture content during compaction.
- (K) Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.
 - (1) Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
 - (2) Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist

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drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

- (3) Stabilization of wet fill material using cement, lime or other chemical methods, and/or geotextiles, will be considered and may be approved subject to the review and approval of the Geotechnical Engineer. Submit proposed stabilization method, including geotextile materials, proposed chemical stabilization materials, mix quantities, or methods and testing criteria for review and approval by the Owner and the Geotechnical Engineer.

13. CLEAN-UP

- (A) The entire site shall be raked clean of all trash and other debris after completion of grading work and excess material removed from the site, prior to proceeding with seeding/sodding. Remove all pavement base, etc. from planting areas.
- (B) Erosion control measures shall be removed after permanent landscaping has been established, or at a time set by the local authorities.

- END OF SECTION -

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SECTION 02511

ASPHALT PAVING

1. GENERAL

- (A) Include all labor, material and equipment to completely install all bituminous paving.

2. WORK SPECIFIED ELSEWHERE

- (A) Excavation, grading and preparation of sub-grade.

3. SUBMITTALS

- (1) Asphalt mix design shall be submitted to the Civil Engineer.

4. QUALITY ASSURANCE

(A) General

- (1) The Owner will employ and pay for the services of an independent testing agency to provide testing and inspection of the asphaltic concrete and stone base work. The testing agency shall be licensed in the state where the structure is located and shall meet the requirements of "Recommended Practices for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction" (ASTM E329). All testing and inspections shall be performed under the supervision of an engineer registered in the state where the structure is located.
- (2) Asphaltic concrete and stone base materials and operations shall be tested and inspected as the work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate the Owner's Representative for final acceptance.
- (3) The testing agency shall report all test and inspection results to the Civil Engineer, Architect, Owner's Representative and Contractor immediately after they are performed. All test and inspection reports shall be signed and sealed by an engineer registered in the state where the structure is located, and shall include the exact location of the work represented by the test.

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- (4) The testing agency and its representatives are not authorized to revoke, alter, relax, enlarge or release any requirement of the contract documents, approve or accept any portion of the work, perform any duties of the Contractor, or be a party to scheduling of work.
 - (5) The Contractor shall notify the testing agency a minimum of 24 hours in advance of all asphaltic concrete and stone base work.
 - (6) Records of inspection shall be kept available to the Owner during progress of work and for two years after completion of the project. Records shall be preserved by the independent testing agency.
- (B) The testing agency shall conduct pre-placement inspections as necessary to determine that:
 - (1) Paving subgrade areas have been constructed per the Soils Report and specifications criteria.
 - (2) All paving section subgrade areas have been inspected, tested and accepted.
- (C) The testing agency shall conduct tests as necessary to determine that:
 - (1) All materials used in the production of asphaltic concrete and stone base meet the requirements of the project specifications.
- (D) The testing agency shall conduct asphaltic concrete and stone base placement inspections as necessary to determine that:
 - (1) Asphaltic concrete has been mixed and transported in accordance with the project specifications.
 - (2) Asphaltic concrete is conveyed to the place of final deposit by methods which prevent separation or loss of material.
 - (3) Asphaltic concrete and stone base are properly compacted. Perform at least one density test for every 20,000 SF of pavement area. Verify stone base thickness by checking stone base thickness at least once for every 20,000 SF of pavement area.
 - (4) Asphaltic concrete is finished within the tolerances specified in section 11 (C) (7) below.
- (E) The testing agency shall conduct post-placement inspection as necessary to determine that:
 - (1) All surface defects are repaired in accordance with the project specifications.

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5. TRANSPORTATION OF MIXTURES

- (A) The mixture shall be transported from the paving plant to the work in tight vehicles with metal bottoms previously cleaned of all foreign materials. The truck beds shall be raised and the inside lubricated with a thin oil to prevent the mixture from adhering to the bed. An excess of lubricant will not be permitted. Each load shall be covered with canvas or other suitable material of sufficient size to protect it from the weather.

6. MATERIALS

- (A) Aggregate for rolled stone base course shall be clean, crushed rock, free from thin or elongated pieces, soft or disintegrated materials, or other foreign matter. Stone shall meet the criteria established for crushed stone base established by the local Department of Transportation.
- (B) Base Paving Section Bid: Include in bid the cost to install pavement cross section as recommended in the Soils Report and as detailed on the drawings.

7. AGGREGATE FOR ASPHALTIC CONCRETE

- (A) Coarse Aggregate shall be natural crushed stone produced from sound, durable rock, free from objectionable coatings. This aggregate shall conform to the requirements of ASTM D-692 and local D.O.T. Standard Specification.
- (B) Fine Aggregate shall consist of natural sand or by special permission may be fines produced by the crushing of natural stone. The fine aggregate shall conform to the requirements of ASTM C-1073 and mineral filler shall conform to ASTM D-242 and local D.O.T. Standard Specification.
- (C) Asphalt Cement shall conform to ASTM D-946 and local D.O.T. Standard Specification.

8. ASPHALTIC CONCRETE MIXTURES

- (A) Asphaltic concrete mixture shall consist of mineral aggregates and asphalt cement combined in such proportions that the composition by weight of the finished mix shall be within the following range for the type specified.
- (B) Asphaltic concrete mixture shall be type per local D.O.T. Standard Specifications for Road and Bridge (latest edition) for the type and thickness specified on the plans.

9. ROLLED STONE BASE

- (A) Preparation of Mixture: The exact proportions of aggregate and water shall be regulated so as to produce a uniform satisfactory mixture. The order of

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sequence in which the aggregate and water shall be drawn or weighted may vary under different conditions. The percentage of water in the mixture may vary with moisture conditions and sources of aggregate, but in no case shall the percentage of water be more than 12 percent by weight, of the total mixture. The finished mixture shall have a moisture content necessary to obtain the maximum density required to comply with the standard compaction test herein specified. In general, the proper moisture content can be judged by the appearance of free water on the surface of the particles. Excess moisture resulting in run-off shall be avoided.

10. CONSTRUCTION OF STONE BASE

- (A) In no case will the Contractor be permitted to place the mixture or manipulate it on muddy or frozen subgrade. Also, no frost or frozen particles shall be placed on the subgrade or compacted.
- (B) Before starting the construction of surface courses, the base shall be cleaned and adjusted to conform with the cross section shown on the plans and to the lines, grades and thickness established. For the purpose of these specifications, this work shall include sweeping, removing all loose, caked or foreign materials. The total cost of adjusting and compacting subgrades and for cleaning and restoring base courses shall be included in the contract price.
- (C) After the subgrade has been properly prepared, the mixture shall be uniformly spread by blades, or other approved equipment, in successive layers of courses to such depth that, when compacted, the base will have the minimum thickness shown on the typical cross section. The Contractor may construct the base in any number of layers which he may find convenient to facilitate compacting, except that, in no case, shall any individual layer have a compacted thickness of more than 4". Each layer shall be compacted, as hereinafter specified, before any succeeding layer is placed. Placement of base shall be in accordance with local D.O.T. Standard Specification.
- (D) If the mixture becomes too dry to permit compaction, water shall be added during the compacting operations in such an amount as to insure proper compaction. If for any reason, the mixture is too wet for proper compaction it shall be allowed to dry until the proper moisture content is obtained.
- (E) The mixture shall be handled in such manner as to avoid undue segregation. If segregation occurs or if the mixture becomes contaminated, such segregated or contaminated materials shall be replaced with materials of suitable quality and gradation, except that areas of surface segregation may be corrected by spreading a quantity of stone screening sufficient to close the voids and bind the loose material firmly in place. The screening shall be wet and rolled so as to create a dense and uniform surface. Segregated or contaminated materials shall be removed and replaced with suitable material at the sole expense of the Contractor. The Contractor shall restrict hauling

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over the completed or partially completed work after inclement weather, or at any time when subgrade material is soft and there is tendency for the subgrade material to work into the surface material. Any screenings used in correcting areas of surface segregation will be measured and paid for as a part of the aggregate constituting the base course. All extra work or expense involved due to screenings being required shall be the Contractor's obligations without extra cost to Owner. Compaction shall be performed by the use of any approved equipment, within the limits of these specifications, which will produce satisfactory results.

- (F) Shaping and compaction shall be carried on until a true, even, uniform base course of the proper grade, cross section and density is obtained. Proper moisture content shall be maintained by wetting the surface as required during shaping and compacting operations. The use of excess water, resulting in run-off or in the formation of a slurry on the surface, shall be avoided.
- (G) Final rolling on the top course of multiple course construction or the top of single course construction shall be accomplished by self-propelled smooth-wheeled roller weighing not less than seven (7) tons, nor more than ten (10) tons.
- (H) The density to be obtained in the completed base shall be at least 98% of the Standard Proctor maximum dry density, per ASTM D698.

11. CONSTRUCTION OF ASPHALTIC SURFACE

- (A) Mixing Plant shall conform to ASTM D-995 and local D.O.T. Standard Specification.
- (B) Preparation of Mixture: The bituminous cement shall be carefully heated without damage by overheating to a workable temperature. The final mixture shall not exceed 350 degrees F. when discharged.
- (C) Application
 - (1) Spreading of mixture shall be done at mixture temperature above 250 degrees F. and only when weather conditions are suitable.
 - (2) Use hand rakes for inaccessible locations and mechanical spreading and finishing machine of type approved by owner's Representative.
 - (3) Side forms to serve as screed or strike off control to insure surface true to elevation or to prevent squeezing out or side shoving under roller or lateral displacement shall be used where applicable. Forms shall be of height equal to thickness of finished course.
 - (4) Rolling shall be carried out while mixture is still hot, with self-propelled

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roller having weight of 200 lbs. per lineal inch of roller. Rolling shall be paralleled to spreading of mixture, from edge toward center, and in manner consistent with good practice getting proper compaction without cracking, shoving or otherwise displacing mixture during hardening process. All places inaccessible to roller shall be compacted by hand tampers or vibratory plates.

- (5) Mixture shall be placed continuously. Roller shall not pass over unprotected end of freshly laid mixture unless further laying is to be delayed for sufficient time to permit mixture to become chilled. In such case, edge of mixture shall be cut back and trimmed to expose unsealed or granular surface for full specified depth of finish course.
- (6) At end of each day's work, joints shall be formed by laying and rolling mixture against boards of thickness of compacted mixture. When laying is resumed, above mentioned exposed edges shall be painted with thin coat of asphaltic cement, and fresh mixture shall be raked against joint, thoroughly tamped with hand tampers, and rolled.
- (7) After final compression, the surface shall be smooth and true to the established crown and grade. It shall have the average thickness specified and shall at no point vary more than one quarter (1/4) inch from the specified thickness. Any low or defective places shall immediately be remedied by cutting out the course at such spots and replacing it with fresh hot mixture which shall be immediately compacted to conform with surrounding area and shall be thoroughly bonded to it. The finished pavement shall be set free from depressions exceeding one-eighth (1/8) inch as measured with a ten (10) foot straight edge paralleling the center line of the roadway. No traffic shall be permitted on the finished pavement until it has cooled to atmospheric temperature.

12. PAVEMENT PAINTING

(A) Scope of Work

- (1) Layout and paint white striping on parking lot surfaces designating parking spaces, driving lanes and other elements noted on the site drawings. Comply with local ordinances when completing this work.
- (2) Do not apply paint in snow, rain, fog or mist, or when relative humidity exceeds 85% unless otherwise permitted by manufacturer. When surface temperature is below 50 degrees F. do not apply paints and special coatings, unless otherwise specified. Stop exterior work sufficiently early to permit film to set up before condensation, frost and moisture, caused by night temperature drops, occur. Do not begin exterior painting until frost or condensation evaporates and surface is moisture free. Comply with manufacturer's written

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requirements and local D.O.T Standard Specification.

- (3) Traffic paint shall be installed in two (2) coats. The minimum required total Dry Film Thickness (DFT) shall be measured in mils.

- (B) Materials

- (1) Parking Areas: All parking lot striping and arrows:

- 2 coats Pratt and Lambert Traffic Paint (each coat 2.0 mils DFT)
30 days between coats. Coordinate with Section 09900 "Painting".
Color: White.

13. PROTECTION

- (A) Provide adequate protection for all adjacent work and areas against any damage or injury by employees, materials, tools, or equipment used in connection with this contract.
- (B) Maintenance of finished asphaltic concrete surfacing will be required until acceptance of work by Owner.

- END OF SECTION -

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SECTION 02520 PORTLAND CEMENT CONCRETE PAVING

A. General

1. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions apply to this section.
2. Summary
 - a. Extent of Portland cement concrete paving is shown on drawings, including curbs, gutters, walkways, sidewalks, flumes, and pavement.
 - b. Prepared sub-base is specified in "Excavation and Grading" section.
 - c. Concrete and related materials.
 - d. Joint fillers and sealers, Section 07920 "Joint Sealants".
 - e. Concrete used within buildings and structural concrete not included in this section.
3. Submittals: Provide samples, manufacturer's product data, test reports, and materials certifications as required in referenced sections for concrete and joint fillers and sealers.
4. Quality Assurance: Codes and Standards - Comply with local governing regulations if more stringent than herein specified.
5. Job Conditions - Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
 - a. Coordinate with requirements for "Temporary Facilities" specified in Division 1.

B. Products

1. Materials
 - a. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

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- (1) Use flexible spring steel forms or laminated boards to form radius bends as required. Coat forms with a non-staining form release agent that will not discolor or deface surface of concrete.
- b. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A-185.
- c. Reinforcing Steel: Deformed billet steel bars, ASTM A615, grade 40.
- d. Portland cement concrete for curb and gutter, sidewalks and miscellaneous cast-in-place flumes and other minor site structures shall have a minimum 28 day compressive strength of 3500 psi, a non-vibrated slump between 2.5 and 4 inches, minimum cement content of 564 pounds per cubic yard, an air entrainment of 5-7% and a maximum water-cement ratio of 0.57.
- e. Portland cement concrete for slab in front of loading docks shall have a minimum 28 day compressive strength of 4500 psi, a non-vibrated slump between 2.5 and 4 inches, minimum cement content of 658 pounds per cubic yard, an air entrainment of 5-7% and a maximum water-cement ratio of 0.49.
- f. Joint filler shall be self-leveling flexible polyurethane joint sealant.
 1. Products:
 - a. Euclid Chemical Co: Eucolastic II.
 - b. Pecora: urexpan NR 200.
 - c. Sonneborn Building Products – Sonoclastil SL 2 Sealant.
 - d. Tremco: THC 900.
 - e. Vulkem: Vulkem 45.
 2. Description:
 - a. Hardness- Shore “A”: A30 minimum
 - b. Movement Capability: +/-25%.
 - c. USDAQ Approved.
- g. Concrete curing agents shall be free from any impurities which may be detrimental to the concrete and meet the requirements specified in Section 296 of North Carolina Department of Transportation Standard Specifications for

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Roads and Structures.

- h. Aggregate for portland cement concrete shall meet the requirements for fine and coarse aggregate of Section 914 of the North Carolina Department of Transportation Standard Specifications for Roads and Structures.
- i. Portland cement and admixtures shall meet the requirements of Section 1000-4 of the North Carolina Department of Transportation Standard Specifications for Roads and Structures.
- j. Water for mixing or curing the concrete shall be free from injurious amounts of oil, salt acid or other products injurious to the finished.

2. Concrete Mix, Design, and Testing

- a. Comply with requirements of applicable Division 3 sections for concrete mix design, sampling and testing, and quality control and as herein specified.
- b. Design mix to produce normal-weight concrete consisting of Portland cement, aggregate, water-reducing or high-range water-reducing admixture (superplasticizer), air-entraining admixture, and water to produce the following properties:

For curb and gutter, sidewalks and miscellaneous cast-in-place flumes and other minor site structures:

- (1) Compressive Strength: 3500 psi, minimum at 28 days, unless otherwise indicated.
- (2) Non-vibrated slump between 2.5 and 4 inches.
- (3) Minimum cement content of 564 pounds per cubic yard.
- (4) Air entrainment of 5-7%.
- (5) Maximum water cement ratio of 0.532.

For slab in front of loading docks:

- (1) *Compressive Strength: 4500 psi, minimum at 28 days, unless otherwise indicated.*
- (2) *Non-vibrated slump between 2.5 and 4 inches.*
- (3) *Minimum cement content of 658 pounds per cubic yard.*
- (4) *Air entrainment of 5-7%.*
- (5) *Maximum water cement ratio of 0.49.*

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C. Execution

1. Surface Preparation
 - a. Remove loose material from compacted sub-base surface immediately before placing concrete.
 - b. Proof-roll prepared sub-base surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.
2. Form Construction
 - a. Set forms to required grades and lines, braced and secured. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.
 - b. Slope step treads at 1/4 inch per foot to drain.
3. Reinforcement: Locate, place and support reinforcement as indicated.
4. Concrete Placement
 - a. General: Comply with requirements of Division 3 sections for mixing and placing concrete, and as herein specified.
 - b. Place concrete by methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
 - c. Deposit and spread concrete in a continuous operation between transverse joints as far as possible. If interrupted for more than 1/2 hour, place a construction joint.
 - d. Curbs and Gutters: Automatic machine may be used for curb and gutter placement at Contractor's option. If machine

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placement is to be used, submit revised mix design and laboratory test results that meet or exceed minimums specified. Machine placement must produce curbs and gutters to required cross-section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified.

- e. Concrete Paving: Place concrete using a concrete pump; depositing concrete directly from a concrete truck will not be allowed for concrete paving. Driving loaded concrete trucks over prepared subgrade will not be allowed.

5. Joints

- a. General: Construct expansion, weakened-plane (contraction), and construction joints true to line with face perpendicular to surface of concrete.

(1) Sawed Joints: Form weakened-plane joints with powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints one inch (1") deep into hardened concrete at maximum fifteen foot (15') spacing, in both directions, as soon as surface will not be torn, abraded, or otherwise damaged by cutting action. *Seal with joint filler material as specified below.*

(2) Expansion joints: Use pre-molded expansion joint material.
Seal joints with joint filler material as specified below.

- b. Construct transverse joints at right angles to the centerline, unless otherwise indicated. Construct contraction joints at intervals equal to the width of sidewalks and at 10' maximum spacing in curb and gutter and slabs. Seal joints with joint filler material as specified below.
- c. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for more than 1/2 hour, except where such placements terminate at expansion joints. Seal joints with joint filler material as specified below.
- d. Expansion Joints: Provide pre-molded expansion joint filler

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abutting concrete curbs, catch basins, manholes, inlets, structures, walks, and other fixed objects, unless otherwise indicated. Provide expansion joint at a maximum 50' spacing (or as indicated on the plans) for slabs, sidewalks and curb and gutter. *Seal joints with joint filler material as specified below.*

- e. Joint filler material shall be mixed and installed in strict accordance with manufacturer's printed installation instructions except where more stringent requirements are shown or specified. Joint surfaces shall be primed as required by manufacturer to insure bonding. Provide backer rod in joint at a uniform depth of $\frac{1}{2}$ the joint width, a minimum depth of $\frac{1}{4}$ " and a maximum depth of $\frac{1}{2}$ ". Take all necessary steps to prevent three sided adhesion. Final cured profile shall be flush with concrete slab surface. *See Section 32-1313 B.1.g. – Products.*

6. Concrete Finishing

- a. After striking-off and consolidating concrete, smooth surface by screening and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.
- b. After floating, test surface for trueness with a 10' straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.
- c. Work edges of gutters, back top edge of curb, and formed joints with an edging tool, and round to $\frac{1}{2}$ " radius, unless otherwise indicated. Eliminate tool marks on concrete surface.
- d. After completion of floating and troweling when excess moisture or surface sheen has disappeared, broom surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to owner.
- e. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Owner.

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f. For joint sealing see Section C.5. - Joints

7. Curing: Protect and cure finished concrete paving in compliance with applicable requirements of Division 3 sections.
8. Repairs And Protections: Repair or replace broken or defective concrete, as directed by Owner.

D. QUALITY ASSURANCE

A. General

1. The Owner will employ and pay for the services of an independent testing agency to provide testing and inspection of the Portland Cement Concrete and stone base work. The testing agency shall be licensed in the state where the structure is located and shall meet the requirements of "Recommended Practices for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction" (ASTM E329). All testing and inspections shall be performed under the supervision of an engineer registered in the state where the structure is located.
2. Portland cement concrete and stone base materials and operations shall be tested and inspected as the work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate the Owner's Representative for final acceptance.
3. The testing agency shall report all test and inspection results to the Project Manager, Owner and Contractor immediately after they are performed. All test and inspection reports shall be signed and sealed by an engineer registered in the state where the structure is located and shall include the exact location of the work represented by the test.
4. The testing agency and its representatives are not authorized to revoke, alter, relax, enlarge or release any requirement of the contract documents, approve or accept any portion of the work, perform any duties of the Contractor, or be a party to scheduling of work.
5. The Contractor shall notify the testing agency a minimum of 24 hours

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in advance of all Portland cement concrete and stone base work.

6. Records of inspection shall be kept available to the building official during progress of work and for two years after completion of the project. Records shall be preserved by the independent testing agency.
- B. The testing agency shall conduct pre-placement inspections as necessary to determine that:
1. Paving subgrade areas have been constructed per the Soils Report and specifications criteria.
 2. All paving section subgrade areas have been inspected, tested and accepted.
- C. The testing agency shall conduct tests as necessary to determine that:
1. All materials used in the production of Portland concrete and stone base shall meet the requirements of the project specifications.
- D. The testing agency shall conduct Portland cement concrete and stone base placement inspections as necessary to determine that:
1. Portland cement concrete has been mixed and transported in accordance with the project specifications.
 2. Portland cement concrete is conveyed to the place of final deposit by methods which prevent separation or loss of material.
 3. Portland cement concrete and stone base are properly compacted. Perform at least one density test for every 20,000 SF of pavement area. [Verify stone base thickness by checking stone base thickness at least once for every 20,000 SF of pavement area.]
 4. Portland cement concrete is finished free from depressions exceeding one-eighth (1/8) inch as measured with a ten (10) foot straight edge in any direction.
- E. The Owner shall conduct post-placement inspection as necessary to determine that:
1. All surface defects are repaired in accordance with the project

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specifications.

-END OF SECTION-

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**SECTION 02668
WATER PIPING**

1. GENERAL

(A) Related documents

- (1) Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.
- (2) Local Department of Transportation Standard Specifications and Details and/or the local water utility agency specifications and details.
- (3) Coordinate with Fire Protection Drawings & Specifications.

(B) Summary

- (1) This Section includes water line and fire line extensions and water service piping and appurtenances from the source of potable water to a point 1 foot above finished floor inside the building.
- (2) Related Sections: The following Sections contain requirements that relate to this Section:
 - (a) Division 2 Section 02211 "Excavation and Backfill" for excavation and backfill required for water service piping and structures.
 - (b) Section 02160 "Excavation Support Systems".
 - (c) Section 0211 Testing.
 - (d) Division 15 "Mechanical" for interior building water piping systems and equipment.
- (3) Products installed but not furnished under this Section include water meters provided by the utility company to the site, ready for installation.

(C) Submittals

- (1) General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- (2) Product data for pipes, valves, meter setter yoke, backflow preventers and identification devices.
- (3) Shop drawings for precast concrete valve pits and meter pit, including

frames and covers, also above ground enclosures (if applicable).

- (4) Record drawings at project closeout of service piping and products in accordance with requirements of Division 1.
- (5) Maintenance data for valves and backflow preventer, for inclusion in Operating and Maintenance Manuals.

(D) Quality Assurance

- (1) Comply with requirements of the local D.O.T. Standard Specifications and Details and local water utility agency specifications and details.
- (2) Obtain approval from governing agencies for taps, public waterline extensions and private water line extensions.

(E) Delivery, Storage and Handling

- (1) Handling: Use a sling to handle valves whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use hand wheels or stems as lifting or rigging points.

(F) Project Conditions

- (1) Site Information: Perform site survey, research public utility records, and verify existing utility locations. Verify that water service piping may be installed in compliance with the original design and referenced standards. Notify Owner and Architect of differences between field conditions and plans.

(G) Sequencing and Scheduling

- (1) Coordinate work on public water mains and connection to public water main with governing agencies having authority for water main management.
- (2) Coordinate service location to building with interior water distribution piping as shown on plumbing plans.
- (3) Coordinate with other utility work.

2. PRODUCTS

- (A) Refer to the site construction drawings for any specifications on pipes and pipe fittings, valves, anchorages, pits and vaults. The more restrictive specifications shall apply.

(B) Pipe and Pipe Fittings, General

- (1) Pipe and pipe fitting materials shall be compatible with each other. Where more than one type of material or product is indicated, selection is Installer's option.
- (2) Ductile-Iron Pipe 4 inches and larger: AWWA C151, Class 50, except that pipe smaller than 6-inch size shall be Class 51.
- (3) PVC (Polyvinyl Chloride) Pipe 4 inches and larger: AWWA C900; Class 200; with bell end and elastomeric gasket, with plain end for cast-iron or ductile-iron fittings, or with plain end for PVC elastomeric gasket fittings.
 - (a) Ductile-Iron and Cast-Iron Fittings: AWWA C110, ductile-iron or cast-iron, 250-psi pressure rating; or AWWA C153, ductile-iron compact fittings, 350-psi pressure rating; of dimension to match pipe outside diameter.
- (4) Copper Water Tube 2 Inches and Smaller: ASTM B 88; Type K, seamless, annealed temper.
- (5) PVC (Polyvinyl Chloride) Pipe 3 Inches and Smaller: ASTM D 1785, Schedule 40.
- (6) Couplings: Iron body sleeve assembly fabricated to match outside diameters of pipes to be joined.

(C) Valves

- (1) Non-rising Stem Gate Valves 3 Inches and Larger: AWWA C500, cast-iron double disc, bronze disc and seat rings, or AWWA C509, resilient seated; bronze stem, cast-iron or ductile-iron body and bonnet, stem nut, 200-psi working pressure, mechanical joint ends.
- (2) Rising Stem Gate Valves, 3 Inches and larger: AWWA C500, cast-iron double disc, bronze disc and seat rings, or AWWA C509, resilient seated; cast-iron or ductile-iron body and bonnet, OS&Y, bronze stem, 200-psi working pressure, flanged ends.
- (3) Non-rising Stem Gate Valves, 2 Inches and Smaller: MSS SP-80; body and screw bonnet of ASTM B 62 cast bronze; with Class 125 threaded ends, solid wedge, non-rising copper-silicon alloy stem, brass packing gland, Teflon-impregnated packing, and malleable iron hand wheel.
- (4) Valve Boxes: Traffic rated (HS 20) cast-iron box having top section and cover with lettering "WATER", bottom section with base of size to fit over valve and barrel approximately 5 inches in diameter, and

adjustable cast-iron extension of length required for depth of bury and valve.

- (5) Curb Stops: Bronze body, ground key plug or ball, and wide tee head, with inlet and outlet to match service piping material.
- (6) Tapping Sleeve and Tapping Valve: Provide a complete assembly, including tapping sleeve, tapping valve, and bolts and nuts. The sleeve and the valve shall be compatible with the tapping machine to be used.
- (7) Service Clamps and Corporation Stops: Provide a complete assembly, including service clamp, corporation stop, and bolts and nuts. The clamp and stop shall be compatible with the drilling machine to be used.

(D) Anchorages

- (1) Clamps, Straps, and Washers: ASTM A 506, steel.
- (2) Rods: ASTM A 575, steel.
- (3) Rod Couplings: ASTM A 197, malleable iron.
- (4) Bolts: ASTM A 307, steel.
- (5) Cast-Iron Washers: ASTM A 126, gray iron.
- (6) Concrete Reaction Backing: Portland cement concrete mix, 3000 psi.

(E) Valve Pits, Meter Pit, and Above Ground Vaults

- (1) Concrete: Portland cement mix, 3000 psi.
- (2) Reinforcement: Steel conforming to the following:
 - (a) Fabric: ASTM A 185, welded wire fabric, plain.
 - (b) Reinforcement Bars: ASTM A 615, Grade 60, deformed.
 - (c) Above ground heated boxes for backflow preventers.
- (3) Ladder: ASTM A 36, steel, or maybe polyethylene-encased cast-iron or steel steps.
- (4) Manhole: ASTM A 48, Class 35, gray iron, 24-inch minimum diameter traffic frame and cover, of size and weight indicated.
- (5) Manhole: ASTM A 536, Grade 60-40-18, ductile iron, 24-inch

minimum diameter traffic frame and cover, of size and weight indicated.

- (6) Drain: ANSI A112.21.1M, area drain, cast iron, of size indicated. Traffic rated lids shall be used in all areas. Body shall have anchor flange, light-duty cast-iron grate, and bottom outlet. Drain shall have integral or field-installed bronze ball or clapper-type backwater valve. Above ground vaults shall have positive drainage to the exterior of the vault.
- (F) Water Meter: Water meter will be furnished by the Local water utility agency on payment of meter setting fee. Meet Local water utility agency requirements for meter box.
- (G) Meter Setter: Meet Local water utility agency requirements for size specified on plans.
- (H) Fire Hydrants: Meet Local water utility agency requirements as specified on plans. Provide pipe bollards as shown on the plans. Paint all above ground piping, valves, bollards and hydrants.

3. EXECUTION

- (A) Refer to the site construction drawings for any specifications on the installation of piping and pipe fittings, valves and anchorages. Also refer to the site drawings for specifications on pipe tests and cleaning. The more restrictive specifications shall apply.
- (B) Preparation of Buried Pipe Foundation
 - (1) Refer to Specification Section 32 1120 Excavation and Grading, for trench compaction criteria. If rock or unsuitable soils are encountered, all work shall comply with Specification Section 32 1120.
 - (2) Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation throughout the length of the piping.
 - (3) Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or gravel to indicated level.
- (C) Installation of Pipe and Pipe Fittings
 - (1) Ductile-Iron Pipe: Install with cement-mortar-lined, ductile-iron or cast-iron, mechanical joint or push-on joint fittings and rubber gaskets in accordance with AWWA C600.
 - (2) PVC (Polyvinyl Chloride) Pipe: Install with cement-mortar-lined,

ductile-iron or cast-iron, mechanical joint or push-on fittings and rubber gaskets in accordance with AWWA M23.

- (3) Copper Tube: Install with wrought copper, solder joint, pressure fittings, and Sn95 Tin-Antimony solder in accordance with CDA "Copper Tube" Handbook.
- (4) PVC (Polyvinyl Chloride) Pipe: Install with PVC, Schedule 30 socket-type, solvent cement or elastomeric gasketed fittings in accordance with manufacturer's installation instructions.
- (5) Depth of Cover: Provide minimum cover over piping of 12 inches below average location frost depth or 36 inches below finished grade, whichever is greater.
- (6) Water Main Connection: Arrange and pay for tap in water main, of size and in location as indicated, from the Local water utility agency.
- (7) Water Main Connection: Tap water main with size and in location as indicated, in accordance with requirements of the Local water management agency.
- (8) Water Service Termination: Terminate water service piping 1 foot above finished floor inside the building in location and invert as indicated. Provide temporary pipe plug for piping extension into building.

(D) Installation of Valves

- (1) General Application: Use mechanical joint end valves for 3-inch and larger buried installation. Use threaded and flanged end valves for installation in pits and inside building. Use bronze corporation stops and valves, with ends compatible to piping, for 2-inch and smaller installation.
- (2) AWWA-Type Gate Valves: Comply with AWWA C600. Install buried valves with stem pointing up and with cast-iron valve box.
- (3) Bronze Corporation Stops and Curb Stops: Comply with manufacturer's installation instructions. Install buried curb stops with head pointed up.

(E) Installation of Anchorages: Provide anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches.

(F) Application of Protective Coatings: Apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of installed ferrous anchorage devices.

(G) Field Quality Control

(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. Provide one compaction test for every 100 LF, or part thereof, of line installed.

(2) Hydrostatic Tests: Test at not less than 1-1/2 times working pressure for 2 hours minimum, or as required by local or state agencies.

Increase pressure in 50-psi increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to 0 psi. Slowly increase gain to test pressure and hold for one more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within above limits.

(3) Castings shall be wire-brushed or otherwise prepared for painting and painted with a flat black rust inhibitive paint.

(H) Cleaning - Clean and disinfect water distribution piping. *Flush and test fire protection lines per fire protection specifications; fire protection engineer to witness flushing of fire lines.*

(I) Valve Schedule: Non-rising Stem Gate Valves - 4 Inches and Larger.

- END OF SECTION -

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SECTION 02720 STORM SEWERS

A. General

1. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.
2. Related Sections: 32 1200 – Testing; 32 1120 – Excavation and Grading and 32 1121 - Excavation Support Systems.
3. Summary: This Section includes storm sewerage system piping and appurtenances from a point 5 feet outside the building to the point of discharge or connection to existing storm sewer.
4. Submittals
 - a. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
 - b. Product data for drainage piping specialties.
 - c. Shop drawings for precast concrete storm drainage manholes and catch basins, including frames, covers, and grates.
5. Project Conditions: Verify that storm sewerage system piping may be installed in compliance with original design and referenced standards.
6. Sequencing and Scheduling
 - a. Coordinate with interior building storm drainage piping.
 - b. Coordinate with other utility work.

B. Products

1. Pipe and Fittings
 - a. General: Provide pipe and pipe fitting materials compatible with each other.
 - b. PVC (Polyvinyl Chloride) Sewer Pipe and Fittings: ASTM D1785, PVC pipe, schedule 40.
 - c. Reinforced Concrete Sewer Pipe and Fittings: ASTM C 76, Class III, Wall B, for mastic joints.

- d. Non-reinforced Concrete Sewer Pipe and Fittings: ASTM C 14, Class 2, for mastic joints.
2. Manholes
- a. Precast Concrete Manholes: ASTM C 478, precast reinforced concrete, of depth indicated.
 - b. Cast-in-Place Manholes: Reinforced concrete of dimensions and with appurtenances indicated.
 - (1) Bottom, Walls, and Top: Reinforced concrete.
 - (2) Channel and Bench: Concrete.
 - (3) Steps: Cast into sidewall at 12- to 16-inch intervals.
 - c. Manhole Steps: 12 inch wide cast iron, galvanized steel or steel encased in corrosion resistant material (rubber or plastic).
 - d. Manhole Frames and Covers: Heavy-duty traffic bearing, cast iron, 24-inch inside diameter by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch-diameter cover, indented top design, with lettering "STORM SEWER" cast into cover.
3. Cleanouts: Provide cast-iron or schedule 80 PVC ferrule and countersunk brass cleanout plug, with round cast-iron access frame and heavy-duty, secured, scoriated cast-iron cover.
4. Catch Basins
- a. Precast Concrete Catch Basins: ASTM C 478 or ASTM C 858, precast reinforced concrete, of depth indicated. Sections shall have provision for rubber gasket joints. Base section slab shall have minimum thickness of 6 inches, riser sections shall have minimum thickness of 4 inches and be 48 inches inside diameter, and top section and grade rings shall match 24-inch frame and grate, unless otherwise indicated.
 - b. Cast-in-Place Catch Basins: Reinforced concrete of dimensions and with appurtenances indicated.
 - (1) Bottom, Walls, and Top: Reinforced concrete.
 - (2) Channel and Bench: Concrete.
 - c. Catch Basin Steps: 12 inch wide cast iron, galvanized steel or steel encased in corrosion resistant material (rubber or plastic).

- d. Catch Basin Frames and Grates: ASTM A 536 Grade 60-40-18, heavy-duty, ductile iron, 24-inch inside diameter by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch-diameter flat grate having small square or short slotted drainage openings.
- e. Curb Inlets: Precast concrete of dimensions conforming to utility standards.

5. Concrete and Reinforcement

- a. Concrete: Portland cement mix, 3,500 psi.
- b. Reinforcement: Steel conforming to the following:
 - (1) Fabric: ASTM A 185, welded wire fabric, plain.
 - (2) Reinforcement Bars: ASTM A 615, Grade 60, deformed.

C. Execution

1. Preparation of Foundation for Buried Storm Sewer Systems

- a. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation, throughout the length of the pipe.
- b. Remove unstable, soft, or unsuitable materials at the surface upon which pipes are to be laid, and backfill with clean sand, pea gravel or crushed stone (100% passing 1-1/2" sieve and 0-5% passing a No. 50 sieve) to indicated level.

2. Pipe Applications for Underground Storm Sewers

- a. Pipe sizes 12 inches and Larger: Reinforced concrete sewer pipe and fittings.
- b. Pipe sizes smaller than 12 inches: PVC sewer pipe or non-reinforced concrete sewer pipe.

3. Installation, General

- a. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of the underground storm sewerage system piping. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical.
- b. Install piping pitched down in direction of flow, at minimum slope of 1 percent, except where indicated otherwise.

- c. Extend storm sewerage system piping to connect to building storm drains, of sizes and in locations indicated.
- 4. Pipe and Tube Joint Construction and Installation
 - a. Join concrete pipe and fittings with mastic in accordance with applicable provisions of ACPA "Concrete Pipe Installation Manual."
- 5. Manholes
 - a. General: Install manholes complete with accessories as indicated. Form continuous concrete or split pipe section channel and benches between inlets and outlet. Set tops of frames and covers flush with finish surface where manholes occur in pavements. Elsewhere, set tops 1 inch above finish surface, unless otherwise indicated.
 - b. Construct cast-in-place manholes as indicated.
 - c. Apply bituminous mastic coating at joints of sections.
- 6. Cleanouts
 - a. Install cleanouts and extension from sewer pipe to clean out at grade as indicated. Set cleanout frame and cover in concrete pad 12"x 12"x 6" deep (minimum), except where location is in concrete paving. Set top of cleanout 1 inch above surrounding earth grade or flush with grade when installed in paving. Coordinate with section 02730 G.
 - b. Castings shall be wire-brushed or otherwise prepared for painting and painted with a flat black rust inhibitive paint.
- 7. Catch Basins
 - a. Construct catch basins to sizes and shapes indicated.
 - b. Set frames and grates to elevations indicated.
- 8. Tap Connections
 - a. Make connections to existing piping and underground structures so that finished work will conform as nearly as practicable to the requirements specified for new work.
 - b. Make branch connections from side into existing 24-inch or larger piping or to underground structures by cutting opening into existing unit sufficiently large to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing

through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

- c. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris, concrete, or other extraneous material that may accumulate.

9. Field Quality Control

- a. Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction. See Sections 02011 and 02211 for testing requirements. Perform one compaction test for every 100 LF, or part thereof, of line installed and under each structure. Perform compaction testing for every 8" lift of backfill in trench and under structure.
- c. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.
- c. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.
- d. Castings shall be wire-brushed or otherwise prepared for painting and painted with a flat black rust inhibitive paint.

-END OF SECTION-

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SECTION 02800
GALVANIZED CHAIN LINK FENCE

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Galvanized (zinc) coated chain link fabric with galvanized steel framework and accessories.

1.02 SUBMITTALS

- A. Changes in specifications may not be made after the bid date unless approved by the Owner.
- B. Shop drawings: Layout of fences and gates with dimensions, details, and finishes of components, accessories, and post foundations.
- C. Product data: Manufacturer's catalog cuts indicating material compliance and specified options.
- D. Samples: If requested, samples of materials (e.g., fabric, wires, and accessories).

1.03 QUALITY ASSURANCE

- A. Fence contractor: Contractor having 5 years experience installing similar projects in accordance with ASTM F567.
- B. Tolerances: ASTM current specification and tolerances apply and supersede any conflicting tolerance.
- C. Substitutions: Alternate chain link products may be acceptable as equal if approved in writing ten days prior to bidding provided that the items submitted meet the specifications contained in this document.
- D. Single source: To ensure system integrity obtain the chain link system, framework, fabric, fittings, gates and accessories from a single source.

PART 2 - PRODUCTS

2.01 CHAIN LINK FENCE FABRIC

- A. Galvanized (zinc) coated steel chain link fabric per ASTM A392
Class 1: weight of zinc coating 1.2 oz/ft²

Size and Height: Chain link fabric: 2 in. mesh, 9 gauge (0.148 in. diameter), wire having a break load of 1290 lbf, mesh height: 72 in.

- B. Selvage of fabric knuckle at top and twist at bottom.

2.02 STEEL FENCE FRAMEWORK

- A. Steel pipe Type I: ASTM F1043 Group IA, ASTM F1083 standard weight schedule 40 hot-dip galvanized pipe having a zinc coating of 1.8 oz/ft² (550 g/m²) on the outside surface and 1.8 oz/ft² (550 g/m²) on the inside surface. Regular Grade: Minimum steel yield strength of 30,000 psi.
- B. Pipe End and Corner Post 2.875 in. OD; 5.79 lbs/ft
- C. Pipe Line Post 2.375 in. OD; 3.65 lbs/ft
- D. Pipe Rail and Braces 1.660 in. OD; 2.27 lbs/ft

2.03 FITTINGS

- A. Post caps: ASTM F626 galvanized pressed steel, malleable iron, or aluminum alloy weather tight closure cap for tubular posts. Provide one cap for each post. "C" shaped line post without top rail do not require post caps. When top rail is specified provide line post loop tops to secure top rail.
- B. Rail ends: Galvanized pressed steel per ASTM F626, for connection of rails to post using a brace band.
- C. Top rail sleeves: 7" (178 mm) galvanized steel sleeve per ASTM F626.
- D. Wire ties: 9 gauge (0.148") (3.76 mm) galvanized steel wire for attachment of fabric to line posts and rails. Pre-formed hog ring ties to be 9 gauge (0.148") (3.76 mm) galvanized steel or aluminum for attachment of fabric to tension wire. Tie wire and hog rings per ASTM F626.
- E. Brace and tension (stretcher bar) bands: ASTM F626 galvanized 12 gauge (0.105") (2.67mm) pressed steel by 3/4" (19mm) formed to a minimum 300 degree profile curvature for post attachment. Secure bands using minimum 5/16" (7.94 mm) galvanized carriage bolt and nut.
- F. Tension (stretcher) bars: Galvanized steel one piece length equal to 2 inches (50 mm) less than full height of fabric with a minimum cross-section of 3/16" x 3/4" (4.76 mm x 19 mm) per ASTM F626. Provide tension (stretcher) bars where chain link fabric is secured to the terminal post.
- G. Truss rod assembly: Galvanized steel minimum 5/16" (7.9mm) diameter truss rod with pressed steel tightener, in accordance with ASTM F626

H. Barbed wire supporting arms: Galvanized pressed steel barb arm per ASTM F626 with provisions for attaching barbed wire. Provide arms with loop hole for applications with top rail. Arms shall withstand 250 lb. (113.5 kg) downward pull at outermost end of arm without failure. Arms provide an additional 13 in. (330 mm) in height. [Type I, 45° 3 strand single arm].

I. Carriage bolts and nuts: Galvanized of commercial quality

2.04 TENSION WIRE

A. Tension wire: ASTM A824 Type II, zinc coated (galvanized) steel wire, 7 gauge, (0.177") diameter wire having a tensile strength of 75,000 psi (517 MPa).

2.05 BARBED WIRE

A. Barbed wire: ASTM A121 design number 12-4-5-14R, 12 ½ gauge, 0.099" (2.51 mm) Type Z Class 3, 0.80 oz/ft² (245 g/m²) zinc coated double-strand twisted line wire with 14 gauge, (0.080") (2.03 mm) Type Z Class 3, 0.70 oz/ft² (215g/m²) zinc coated 4 point barbs spaced an average of 5" (127 mm) on center.

2.06 CHAIN LINK SWING GATE

A. Swing gates: double leaf & single leaf as indicated on plans (6' high plus 1' 0" 3 strands barbed wire). Fabricate chain link swing gates in accordance with ASTM F900. Gate frame to be of welded construction. Weld areas to be protected with zinc-rich paint per ASTM A780. The gate frame members are to be spaced no greater than 8' 0" (2.44 m) apart horizontally or vertically. Exterior members to be 1.900" (48.3 mm) OD pipe, interior members when required shall be 1.660" (42.2 mm) OD pipe. Pipe to be Grade 1 ASTM F1083 per section 2.03. Chain link fabric to match specification of fence system. Fabric to be stretched tightly and secured to vertical outer frame members using tension bar and tension bands spaced 12" (304.8 mm) on center and tied to the horizontal and interior members 12" (304.8 mm) on center using 9 gauge galvanized steel ties per section 2.04.

B. Hinges, hot dip galvanized pressed steel or malleable iron, structurally capable of supporting gate leaf and allow opening and closing without binding. Non-lift-off type hinge design shall permit gate to swing 180° (3.14 rad)

C. Latch: Galvanized forked type capable of retaining gate in closed position and have provision for padlock. Latch shall permit operation from either side of gate.

D. Double gates: Provide galvanized drop rod with center gate stop pipe or receiver to secure inactive leaf in the closed position. Provide galvanized pressed steel locking latch, requiring one padlock for locking both gate leaves, accessible from either side.

- E. Gate holdback: Provide galvanized gate hold back keeper for each gate leaf over 5' (1524 mm) wide. Gate keeper shall consist of mechanical device for securing free end of gate when in full open position.
- F. Gate posts: Grade 1 pipe ASTM F1083 per section 2.03, select gate post from table below.

Gate leaf width	
up to 6 ft.	2.875 in.
over 6 ft. to 12 ft.	4.000 in.
over 12 ft. to 18 ft.	6.625 in.

2.07 POST SETTING MATERIALS

- A. Concrete: Minimum 28 day compressive strength of 3,000 psi (20 MPa).
- B. Drive Anchors: Galvanized ASTM A36 steel drive anchor angle blades, 1" x 1" x 30 " long secured to post with a galvanized shoe clamp. [drive anchors are limited to post size 2.785" OD or less].

PART 3 EXECUTION

3.01 SITE EXAMINATION

- A. Ensure property lines and legal boundaries of work are clearly established.
- B. Survey of fence location to be provided by general contractor.
- C. Verify areas to receive fencing are completed to final grade.

3.02 CHAIN LINK FRAMEWORK INSTALLATION

- A. Install chain link fence system in accordance with ASTM F567 and manufacturer's instructions.
- B. Locate terminal post at each fence termination and change in horizontal or vertical direction of 30° or more.
- C. Space line posts uniformly maximum 10' on center.
- D. Concrete set posts: Excavate holes in firm, undisturbed or compacted soil. Holes shall have diameter 4 times greater than outside dimension of post, and depths approximately 6" deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads. Set post bottom 36" below surface when in firm, undisturbed soil. Place concrete around posts in a continuous pour. Trowel finish around post and slope to direct water away from posts.

Drive Anchor set line posts: With protective cap, drive post 36" (914 mm) into ground. Excavate a 6" (152.4 mm) diameter by 6" (152.4 mm) deep section around post to accommodate the drive anchor shoe clamp. Drive the 2 diagonal drive anchor angle blades into the soil and securely tighten the angle blades to post via the shoe clamp, backfill hole.

- E. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.
- F. Bracing: Install horizontal brace and truss assembly at mid-height or above for fences 6' (1829 mm) and over at each fabric connection to the terminal post. The diagonal truss rod is installed at the point where the brace rail is attached to the terminal post and diagonally down to the bottom of the adjacent line post. Place the truss rod in tension by adjusting the turnbuckle.
- G. Tension wire: Install tension wires so that it will be located 4" (101.6 mm) up from bottom the fabric. If top rail is not specified, install the tension wire so that it will be located 4" (101.6 mm) down from the top of the fabric. Stretch and install tension wire before installing the chain link fabric and attach it to each post using wire ties.

3.03 BARBED WIRE INSTALLATION

- A. Uniformly space and stretch barbed wire between terminal posts. Attach barbed wire to the terminal posts using brace bands and snap and secure barbed wire into each line post barb arm slot.

3.04 CHAIN LINK FABRIC INSTALLATION

- A. Fabric: Install fabric on security side, pull fabric taut; thread the tension bar through fabric and attach to terminal posts with tension bands spaced maximum of 15" (381 mm) on center and attach so that fabric remains in tension after pulling force is released. Install fabric so that it is 2" (50 mm) +/- 1" (25 mm) above finish grade.
- B. Secure fabric using wire ties to line posts at 15" (381 mm) on center and to rails and braces 24" (610 mm) on center, and to the tension wire using hog rings 24" (610 mm) on center. Tie wire shall be secured to the fabric by wrapping it two 360 degree turns around the chain link wire pickets. Cut off any excess wire and bend back so as not to protrude so as to avoid injury if a pedestrian may come in contact with the fence.

3.05 CHAIN LINK GATE INSTALLATION

- A. Swing gates: Installation of swing gates and gate posts shall be per ASTM F567. Direction of swing shall be as shown on drawings. Gates shall be hung plumb in

the closed position with minimal space from grade to bottom of gate leaf. Double gate drop bar receiver shall be set in a minimum concrete footing 6" (152 mm) diameter by 24" (610 mm) deep. Gate leaf holdbacks shall be installed on all double gates and all gate leafs greater than 5' in width.

3.06 SITE CLEAN UP

- A. Clean up area adjacent to fence line from debris and unused material created by fence installation.

- END OF SECTION-

SECTION 02810
PVC COATED CHAIN LINK FENCE

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Poly Vinyl Chloride (PVC) coated chain link fabric with painted steel framework and accessories.

1.02 SUBMITTALS

- A. Changes in specifications may not be made after the bid date unless approved by the Owner.
- B. Shop drawings: Layout of fences and gates with dimensions, details, and finishes of components, accessories, and post foundations.
- C. Product data: Manufacturer's catalog cuts indicating material compliance and specified options.
- D. Samples: If requested, samples of materials (e.g., fabric, wires, and accessories).

1.03 QUALITY ASSURANCE

- A. Fence contractor: Contractor having 5 years experience installing similar projects in accordance with ASTM F567.
- B. Tolerances: ASTM current specification and tolerances apply and supersede any conflicting tolerance.
- C. Substitutions: Alternate chain link products may be acceptable as equal if approved in writing ten days prior to bidding provided that the items submitted meet the specifications contained in this document.
- D. Single source: To ensure system integrity obtain the chain link system, framework, fabric, fittings, gates and accessories from a single source.

1.04 PRODUCT HANDLING AND STORAGE

- A. Upon receipt at the job site, all materials shall be checked to ensure that no damages occurred during shipping or handling.
- B. Materials shall be stored in such a manner to ensure proper ventilation and drainage and to protect against damage, weather, vandalism and theft.

PART 2 – MATERIALS

2.01 MATERIAL – STEEL FRAMEWORK

- A. The steel material used shall be zinc-coated steel strip, galvanized by the hot-dip process conforming to the criteria of ASTM A653/A653M and the general requirements of ASTM A924/A924M.
- B. The zinc used in the galvanizing process shall conform to ASTM B6. Weight of zinc shall be determined using the test method described in ASTM A90 and shall conform to the weight range allowance for ASTM A653, Designation G-90.
- C. The framework shall be manufactured in accordance with commercial standards to meet the strength (50,000 psi minimum yield strength) and coating requirements of ASTM F1043, Group IC, Electrical Resistance Welded Round Steel Pipe, light industrial weight.
- D. The exterior surface of the electrical resistance weld shall be recoated with the same type of material and thickness as the basic zinc coating.
- E. The manufactured framework shall be subjected to a complete thermal stratification coating process (multi-stage, high-temperature, multi-layer) including, as a minimum, a six-stage pretreatment/wash (with zinc phosphate), an electrostatic spray application of an epoxy base, and a separate electrostatic spray application of a polyester finish.
- F. The material used for the base coat shall be a (gray color) thermosetting epoxy; the minimum thickness of the base coat shall be two (2) mils. The material used for the finish coat shall be a thermosetting “no-mar” TGIC polyester powder; the minimum thickness of the finish coat shall be two (2) mils. The stratification coated pipe shall demonstrate the ability to endure a salt-spray resistance test in accordance with ASTM B117 without loss of adhesion for a minimum exposure time of 3,500 hours. Additionally, the coated pipe shall demonstrate the ability to withstand exposure in a weather-ometer apparatus for 1,000 hours without failure in accordance with ASTM D1499 and to show satisfactory adhesion when subjected to the cross-hatch test, Method B, in ASTM D3359. The polyester finish coat shall not crack, blister or split under normal use.
- G. The color of all framework shall be black in accordance with ASTM F934.

- H. The strength of the framework shall conform to the requirements of ASTM F1043; the minimum weight shall not be less than 90% of the nominal weight (see Table 1). The strength of line, end, corner and pull posts shall be determined by the use of 4' or 6' cantilevered beam test. The top rail shall be determined by a 10' free-supported beam test (see Table 1). An alternative method of determining pipe strength is by the calculation of bending moment (see Table 1). Conformance with this specification can be demonstrated by measuring the yield strength of a randomly selected piece of pipe from each lot and calculating the section modulus. The yield strength shall be determined according to the methods described in ASTM E8. For materials under this specification, the 0.2 offset method shall be used in determining yield strength. Terminal posts, line posts and top/bottom rails shall be precut to specified lengths.

2.02 MATERIAL – FENCE FABRIC

- A. The material for chain link fence fabric shall be manufactured from galvanized steel wire. The weight of zinc shall meet the requirements of ASTM F668, Table 4. Galvanized wire shall be PVC-coated to meet the requirements of ASTM F668. The class of the fence fabric shall be Class 1.
- B. Selvage: Top edge knuckled and bottom edge twisted.
- C. Color: The coating color for the fence fabric shall be black. Reference ASTM F668 and ASTM F934.
- D. Wire Size: The size of the steel wire core shall be 9 gauge. (See Table 2); the finished size of the coated wire shall be 0.148 inches (See Table 2).
- E. Height and Mesh Size: The fabric height shall be 4 feet high with a mesh size of 2 inches. (See Table 2).

2.04 MATERIAL – FENCE FITTINGS

- A. The material for fence fittings shall be manufactured to meet the requirements of ASTM F626. The coating for all fittings shall be the same color coating system required for the framework (see 2.01); the color of all fittings and fasteners shall be black in accordance with ASTM F934. All fasteners shall be stainless steel.

2.05 MATERIAL – GATES

- A. Swing gates shall be manufactured and coated to meet the requirements of ASTM F900. Slide gates shall be manufactured to meet the requirements of ASTM F1184. The color of all gates shall be black in accordance with ASTM F934.

PART 3 – EXECUTION

3.01 PREPARATION

- A. All new installation shall be laid out by the contractor in accordance with the construction plan.

3.02 INSTALLATION

- A. Install chain link fence in accordance with ASTM F567. Fence posts shall be set at spacings of a maximum of 10' o.c. Gate posts shall be spaced according to the gate openings specified in the construction plans. Install fabric on security side and attach with wire ties or clip to line posts at 15 inches o.c. and to rails, braces and tension wire at 24 inches o.c.

3.03 CLEANING

- A. The contractor shall clean the jobsite of excess materials. Post hole excavations shall be scattered uniformly away from posts.

TABLE 1

Fence Industry	Decimal O.D. Equivalent		Pipe Wall Thickness		Weight		Section Modulus Inches	x	Min. Yield Strength psi	=	Max. Bending Moment lb. in.	Calculated Load (lbs.)		
	O.D.	Inches	(mm)	Inches	(mm)	lb./ft.	(kg/m)					10' Free Supported	4' Cantilever	6' Cantilever
1-3/8"	1.315	33.40	.080	2.03	1.06	1.57	.0900	x	50,000	=	4,500	150	N/A	N/A
1-5/8"	1.660	42.16	.085	2.16	1.43	2.13	.1574	x	50,000	=	7,870	262	164	109
2"	1.900	48.26	.090	2.29	1.74	2.59	.2208	x	50,000	=	11,040	N/A	230	154
2-1/2"	2.375	60.33	.095	2.41	2.32	3.45	.3734	x	50,000	=	18,670	N/A	389	259
3"	2.875	73.03	.111	2.82	3.26	4.85	.6365	x	50,000	=	31,825	N/A	663	442

TABLE 2

Finished Gauge	Finished OD (NOM)	Core Diameter (NOM)	PVC Coating Thickness	Mesh Sizes Available	Fabric Extrusion Type	Minimum Breaking Strength
8	.162 (4.11 mm)	.120 (3.05 mm)	.015 - .025 (0.38 - 0.64 mm)	2 (50 mm); 1-3/4 (44 mm); 1 (25 mm)	CLASS 1, 2A	850#
9	.148 (3.76 mm)	.097 (2.46 mm)	.015 - .025 (0.38 - 0.64 mm)	2 (50 mm); 1-3/4 (44 mm); 1-1/4 (32 mm); 1 (25 mm)	CLASS 1, 2A	650#

-END OF SECTION-

SECTION 02900 LANDSCAPING

1. GENERAL

- (A) The general provisions of Division 1 apply to the work specified in this Section
- (B) The work in this Section consists of furnishing all materials, accessories, equipment, tools, transportation and performing all services and labor required to completely execute the fertilizing, liming, seeding, and landscaping work as shown on the drawings and as herein specified.
- (C) Liming, fertilizing, and seeding shall include all disturbed areas and all areas shown on plans.
- (D) Location, quantity, and size of all plants shall be as indicated on the drawings.
- (E) All materials shall be subject to the approval of the Owner's Representative.
- (F) All soil and rubbish resulting from the work to be removed from site.
- (G) Contractor shall repair damage of any kind done to the building, parking lot or to the work of other Contractors by the carelessness of his own workmen or otherwise during the progress of work.

2. JOB CONDITIONS

- (A) Before commencing work, this contractor shall verify all conditions at the job. Report any necessary corrections immediately to the General Contractor. Do not proceed until corrections (if any required) are made. Commencing work implies this contractor's acceptance of job conditions.

3. PLANTS

- (A) Plants shall be typical of their species and variety; have normal growth habits; well-developed branches, densely foliated vigorous fibrous root systems, and shall be free from defects and injuries.
- (B) Quality and size of plants, spread of roots, and size of balls shall be in accordance with ASA Z60.1-1959, "American Standard for Nursery Stock" as published by the American Association of Nurserymen, Inc.
- (C) Plants shall be pruned as specified before planting.
- (D) Plants shall be freshly dug and nursery grown.

- (E) Each bundle of plants and all separate plants shall be properly identified by weatherproof labels securely attached thereto before delivery to project site.
- (F) Shrubs shall be well-shaped and full.
- (G) All trees must have straight trunks with a single leader intact. Bark shall be free of abrasion; all fresh cuts over 1-1/4 inch shall be calloused over.
- (H) Trees will not be accepted which have had their leaders cut or which have leaders damaged so that cutting is necessary.

4. DIGGING AND HANDLING

- (A) Handle all plants so that roots and foliage are adequately protected at all times.
- (B) No plant shall be bound with rope or wire at any time so as to damage the bark, break branches or destroy its natural shape.
- (C) Balled, burlapped plants shall come from soil which will hold firm ball.
- (D) Container sizes refer to inside diameter of pot. The plants must have been growing in the specified pot for a minimum of three months and a maximum of one year prior to delivery.

5. PLANTING TREES AND SHRUBS

- (A) Work shall be done under the supervision of an experienced nurseryman approved by the Owner's Representative.
- (B) When conditions are such, by reason of drought, high winds, excessive moisture, or other similar factors, that satisfactory results are not likely to be obtained, work shall be stopped. It shall not be resumed until desired results can be obtained or until approved alternate or corrective measures and procedures are adopted.
- (C) The depth for excavation of plant pits shall be the depth below finished grade required to accommodate beneath the ball or roots a bed of top soil not less than 6 inches in depth. The ball or roots shall rest on this bed when the plant is properly set to finished grade.
- (D) Set all plants plumb and straight. Set at such a level that, after settlement, a normal relationship of the crown of the plant with the ground surface will be established. Locate plant in the center of the pit.
- (E) When balled, burlapped plants are set, tamp topsoil carefully under and around base of ball to fill all voids. Remove all burlap, ropes, and wires from

sides and tops of balls, but do not remove burlap from under ball.

- (F) Plant pits and shrub beds shall not be backfilled with topsoil until approved by Owner's Representative.
- (G) Backfilling topsoil shall be placed in not more than 6 inches increments of depth between tampings. Water thoroughly at each level with a solution of root stimulant and water.
- (H) All planted areas, not including seeded or sod areas, shall receive a permeable fabric weed barrier prior to placing mulch or ground cover.

6. GUYING AND STAKING

- (A) All guying, staking and wrapping shall be done immediately after planting.
- (B) Protect all trees from contact with wires and stakes by sections of rubber hose sufficient length to prevent injury to the tree.
- (C) For balled, burlapped plants: Drive stakes into ground outside periphery of ball of tree.
- (D) Plants shall stand plumb after staking and guying.
- (E) All seals and labels are to remain unbroken and visible on plant material until final inspection. Remove all seals and labels immediately after final inspection.

7. PRUNING

- (A) Prune in a manner to retain height and spread as given in the Plant List.
- (B) Prune in a manner to preserve natural character of plant and in a manner appropriate to its particular requirement in the landscape design.

8. GROUND PREPARATION

- (A) Not earlier than 24 hours before sod is to be laid, the soil surface to be sodded shall be worked to a depth of not less than two (2) inches with a weighted disc rototiller, pulvimixer, or other equipment approved by the Owner's Representative, until the surface is smooth, free from debris, washes, gulleys, clods and stones. If as a result of a rain, the prepared surface becomes eroded or crusted before the sod is to be laid, it shall again be placed in condition for sodding.

9. MULCHING

- (A) Mulch to be grade shredded hardwood mulch. Apply at least 3" of Mulch to earth saucers and plant beds immediately upon completion of planting. Refer to Section 02900, Paragraph 5(l), for weed barrier placement required prior to application of mulch.

10. SEEDING

- (A) See all disturbed areas as specified in City of Dunn Standard Detail 400.16 "Temporary Seeding Specification" or City of Dunn Detail 400.17 "Permanent Seeding Specification" (See SITE 600 Details).
- (B) This contractor shall maintain all seeded areas until the seeded areas are established. If necessary, the contractor shall provide netting in addition to mulch and tack in areas that are difficult establish ground cover. The contractor shall fill, re-grade and re-seed any eroded areas greater than 2 square feet in area as quickly as possible after being notified of the defect. If the eroded area(s) are not repaired within one week (seven calendar days), the Owner may have the repairs done by other and deduct the cost of these repairs from monies due the contractor or charge the money against the warranty bond if the repair is done during the warranty period.
- (C) Contractor to furnish watering hoses and sprinkling equipment for his use during watering period.

11. WARRANTY

- (A) The work under this section shall be warrantied for one (1) year from the date of acceptance. Warranty shall cover replacement of unhealthy plants, defects in workmanship and establishment of groundcover. The warranty on any plant or workmanship corrected under the warranty shall extend the warranty for the replaced plant or workmanship for one year from the date of replacement or correction of defects in workmanship.

-END OF SECTION-

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section specifies cast-in-place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes. Refer to Section 03350 for interior concrete floor slabs and Section 03356 for concrete floor finishing.

1.02 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Product Data: Twisted Steel Micro Rebar (TSMR) reinforcement manufacturer's standard product description and dosage and mixing instructions.
- C. Informational Submittals:
 - a. Test Reports: Uniform Evaluation Service (UES) certified test results for Twisted Steel Micro Rebar (TSMR) reinforcement.
 - b. Batch Tickets: When Twisted Steel Micro Rebar (TSMR) reinforcement is added at a ready-mix plant, furnish batch tickets indicating:
 - i. Information required by ASTM C94.
 - ii. Type and amount of Twisted Steel Micro Rebar (TSMR) reinforcement added to concrete mix.
- B. Design Mixes: For each concrete mix, in accordance with ACI 301, "Specifications for Structural Concrete", Chapter 3.
- C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315 "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork. Design and engineering of formwork are

Contractor's responsibility.

- a. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
 - b. Provide formwork and shoring drawings as required by the North Carolina Threshold Law.
- E. Shop drawings: Indicate placement of Armor-Edge® joint and n2e joint assemblies.
- a. Indicate dimensions and spacings.
 - b. Comply with ACI 302.1 R-04, ACI 360R-06, ACI Detailing Manual (SP-66) and PNA installation guides indicating arrangement of armored joint accessories.
- E. Welding certificates.
- F. All shop drawings shall be signed and sealed by a North Carolina licensed engineer.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete Work 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.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94, "Standard Specification for Ready-Mixed Concrete" requirements for production facilities and equipment.
- C. Source Limitations: Obtain each type of cement of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- D. Welding: Qualify procedures and personnel according to AWS D1.4 "Structural Welding Code--Reinforcing Steel."
- E. Comply with ACI 301 "Specification for Structural Concrete," including the following, unless modified by the requirements of the Contract Documents:
 - 1. General requirements, including submittals, quality assurance, acceptance of structure, and protection of in-place concrete.
 - 2. Formwork and form accessories.
 - 3. Steel reinforcement and supports.
 - 4. Concrete mixtures.

5. Handling, placing, and constructing concrete.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Store Twisted Steel Micro Rebar (TSMR) reinforcement in protected, dry location until used; prevent contamination by other materials
- B. Deliver Armor-Edge® joint and n2e joint assemblies in manufacturer's packaging.
 - a. Deliver and handle materials to prevent damage or weakening to assemblies.
 - b. Prevent accumulation of rust, debris or deleterious materials on assemblies.

PART 2 - PRODUCTS

2.01 FORMWORK

- A. Furnish formwork and form accessories according to ACI 301, "Specifications for Structural Concrete".

2.02 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, "Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement", Grade 60, deformed.
- B. Plain Steel Wire: ASTM A 82, "Standard Specification for Steel Wire, Plain, for Concrete Reinforcement" as drawn.
- C. Plain Steel Welded Wire Fabric: ASTM A 185, "Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete", fabricated from as-drawn steel wire into flat sheets.
- D. Deformed Steel Welded Wire Fabric: ASTM A 497, "Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete", flat sheet.

2.03 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, "Standard Specification for Portland Cement", Type I.
- B. Fly Ash: Not permitted except at pavement.

- C. Normal Weight Aggregates: ASTM C 33, "Standard Specification for Concrete Aggregates", uniformly graded, not exceeding 3/4 inch nominal size.
- D. Water: Potable and complying with ASTM C 94, "Standard Specification for Ready-Mixed Concrete".

2.04 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures. Do not use admixtures containing calcium chloride.
- B. Air-Entraining Admixture: ASTM C 260, "Standard Specification for Air-Entraining Admixtures for Concrete".
- C. Water-Reducing Admixture: ASTM C 494," Standard Specification for Chemical Admixtures for Concrete" Type A.
- D. Water-Reducing and Accelerating Admixture: ASTM C 494," Standard Specification for Chemical Admixtures for Concrete" Type E.
- E. Water-Reducing and Retarding Admixture: ASTM C 494," Standard Specification for Chemical Admixtures for Concrete" Type D.

2.05 RELATED MATERIALS

- A. Vapor Retarder: Polyethylene sheet, ASTM E 1745, Class A, not less than 10 mils thick.
- B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, "Standard Classification for Sizes of Aggregate for Road and Bridge Construction", Size 10, with 100 percent passing a No. 4 sieve and 10 to 30 percent passing a No. 100 sieve; complying with deleterious substance limits of ASTM C 33, "Standard Specification for Concrete Aggregates", for fine aggregates.
- C. Polyurethane Joint Sealer: For horizontal and vertical joints.
 - 1. Product: "Ceramarc"; W.R. Meadows, Inc.
- D. Epoxy Joint Sealer: Semirigid epoxy.
 - 1. Product: "MM80"; Metzger McGuire Co.
- E. Twisted Steel Micro Rebar (TSMR) Reinforcement:

1. Source: Helix 5-25 by Helix Steel (www.helixsteel.com) [or approved substitute].
 2. Description: High-carbon, galvanized, cold-drawn steel wire conforming to ASTM A820, Type 1, continuously twisted about its axis, free from surface contaminants.
 3. Tensile strength: 268.3 KSI (1850 MPa).
 4. Galvanized coating thickness: Minimum 3 grams per square meter.
 5. Length: 1.0 inch (25 mm).
 6. Equivalent diameter: Maximum 0.02 inch (0.50 mm).
- F. Armored Joint Assemblies For Formed Construction Joints
1. Acceptable manufacturer: PNA Construction Technologies, www.pna-inc.com; 800-542-0214.
 2. Acceptable product: PNA Armor-Edge® Joint Assembly.
 3. Material:
 - a. Bars: Saw cut from cold rolled steel bar meeting ASTM A 108-03 grade 1018 to within 3/16" of specified length.
 - b. Mounting brackets shall be manufactured from steel as provided by manufacturer.
 - c. Shipping nut assembly to ensure alignment of armored joint assembly shall contain a nylon nut, bolt and ferrule.
 4. Fabrication:
 - a. Bolt 2 - 2" by 3/8" steel bars back-to-back with a 4" offset and drill holes to hold two plates in perfect alignment together at 2' spacing with shipping nut assembly.
 - b. Use mounting bracket for installation only.
 - c. Weld 4" by 3/8" headed studs at 1 2" on center to steel bars.
 5. Assembly length: 1 2'-0" with 24" offset
- G. Armored Joint Assemblies For New To Existing Slab Transitions
1. Acceptable product: PNA Armor-Edge® n2e Joint Assembly.
 2. Material:
 - a. Plates: Saw cut from cold rolled steel bar meeting ASTM A 36 to within 3/16" of specified length.
 - b. Bars: Saw cut from cold rolled steel bar meeting ASTM A 108-03 grade 1018 to within 3/16" of specified length.
 - c. Anchor bolts, square dowels, square dowel clips and assembly bracket shall be as provided by assembly manufacturer.
 - d. Nylon shipping nut assembly: Nylon nut shall hold studded bar in position during new slab cast and shall be designed to yield under tension thus allowing completed joint to open freely while concrete undergoes its normal drying shrinkage.
 - e. Square dowel clips: Contain compressible foam on each

vertical side to allow horizontal movement parallel and perpendicular to joint. Length shall be +/- 3/16" of 1/2 total dowel length plus 1".

- f. Square dowels: Saw cut from hot rolled steel bar meeting ASTM A 36 to within 3/16" of specified length.

3. Fabrication:

- a. Bolt a continuous 4-1/2" by 1/4" plate back-to-back with a continuous 2" by 3/8" square edged bar and hold together with a combination of nylon and steel nuts.
- b. Steel nut shall be used for shipping only.
- c. Weld 4" by 3/8" anchors at 12" on center to steel bar.
- d. Assembly length: 12'-0".
- e. Ship assembly with seven 3/4" by 12" square dowels, seven 3/4" by 7" square dowel clips and five anchor bolts.

H. Diamond-Shaped Load Plate For Construction Joints

- 1. Acceptable product: PNA Diamond Dowel® System.

2. Material:

- a. Diamond-shaped load plate: 1/4" and 3/8" saw cut from hot rolled steel plate meeting ASTM A 36. 3/4" saw cut from cold rolled steel plate for acceptable tolerances meeting ASTM 108-03 grade 1018.
- b. Pocket former: High density plastic with internal collapsible fins and spacer that hold diamond shaped load plate in correct position and creates a void to its vertical faces. This void, in addition to its tapered shape, shall allow for differential movement and shall prevent horizontal stress accumulation at joint, thus reducing likelihood of random cracking. REFER TO ACI 302.1R-04 FOR SELECTION OF PLATE SIZE AND SPACING.
- c. Dimensions of plate: as indicated on the drawings

2.06 CURING MATERIALS

- F. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- G. Absorptive Cover: AASHTO M 182, Class 2, "Burlap cloth made from jute or kenaf", weighting approximately 9 oz./sq. yd. dry.
- H. Moisture-Retaining Cover: ASTM C 171, "Standard Specification for Sheet Materials for Curing Concrete", polyethylene film or white burlap-polyethylene sheet.
- I. Water: Potable.
- J. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309,

“Standard Specification for Liquid Membrane-Forming Compounds for
Curing Concrete”, Type I, Class B.

2.07 CONCRETE MIXES

- F. Comply with ACI 301, “Specifications for Structural Concrete”, requirements for concrete mixtures.
- G. Design mixes to provide normal weight concrete with the following properties:
 - 1. Footings, Stairs:
 - a. 28 Day Strength: As indicated.
 - b. Slump Range: As indicated.
 - c. Admixtures: None required.
 - 2. Interior Slab-on-Grade:
 - a. 28 Day Strength: As indicated.
 - b. Max. Required Aggregate Size: As indicated
 - c. Max. W/C Ratio: 0.52
 - d. Slump Range: 4.5 inches +/- 1/2 inch. Concrete with a slump as measured per ASTM C143 exceeding 5 inches at the point of deposit on the sub-base shall be rejected.
 - e. Admixtures:
 - 1) Water-reducing, 6 oz./100 lbs. cement max.
 - 2) Accelerating permissible when ambient air temperature less than 40 degrees F, quantity as approved by Engineer.
 - 3. Tilt-Up Wall Panels:
 - a. 28 Day Strength: As indicated.
- H. Add air-entraining admixture at manufacturer’s prescribed rate as indicated.
 - 1. Air content of trowel-finished interior concrete floors shall not exceed 2.0 percent.
- I. Twisted Steel Micro Rebar (TSMR) Reinforcement:
 - 1. Add to Interior Slab on Grade concrete mix in accordance with ASTM C1116.
 - 2. Dosage rate: In accordance with manufacturer’s instructions.

2.08 CONCRETE MIXING

- F. Ready-Mixed Concrete: Comply with ASTM C 94, "Standard Specification for Ready-Mixed Concrete".
- G. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94, "Standard Specification for Ready-Mixed Concrete". Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
 - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.01 FORMWORK

- H. Design, erect, shore, brace, and maintain formwork according to ACI 301, "Specifications for Structural Concrete".
- I. Coat forms with a commercial compound that will not bond or adversely affect the concrete.
- J. Coordinate locations of all openings, embeds, and accessories required
- K. by other trades. Do not place any openings or sleeves in beams or columns unless approved by Engineer.
- L. Chamfer exposed edges of columns and beams 3/4 inch, unless otherwise indicated on Drawings.

3.02 VAPOR RETARDER

- H. Install, protect, and repair vapor retarder sheets according to ASTM E 1643, "Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs"; place sheets in position with longest dimension parallel with direction of pour.
 - 1. Use 10 mil Stego Wrap or approved equal.

- I. Lap joints and seams 6 inches and seal continuously with manufacturer's recommended tape.
- J. Seal all penetrations.

3.03 STEEL REINFORCEMENT

- H. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- I. Minimum Lap Splice: 30 diameters, unless otherwise indicated on Drawings.
- J. Bar Cover minimum:
 - 1. Footings, Retaining Walls: 3 inches.
 - 2. Columns, Beams, Slabs: 1-1/2 inches.
- K. Provide corner bars that match horizontal bars at all wall footings and tie beams.
- L. Reinforcement welding, if required, to comply with AWS D1.4, "Structural Welding Code - Reinforcing Steel".
- M. Welded Wire Fabric (Slabs on Grade): Lap mesh minimum 6 inches at joints.
- N. Install ties, spacers, chairs, and similar items necessary to securely hold reinforcing during concrete placement. Use plastic tips at all exposed surfaces.

3.04 JOINTS

- H. General: Construct joints to line with faces perpendicular to surface plane of concrete.
- I. Construction Joints: Locate and install so as not to impair strength or appearance of concrete, at locations indicated or as approved by Architect.
- J. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
- K. Contraction (Control) Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8 inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- L. Clean and fill all sawcut joints and all construction joints with specified joint sealer.
- M. Installation of armored edge joint assembly:
1. Set wood form 2" below top of slab. Stake form.
 2. Mark chalk-line on wood forms 3/4" above slab center or minimally at top of form so center line of the Diamond Dowel® plate will be a minimum of 2- 1 /4" below top of slab.
 3. Attach Diamond Dowel® pocket former onto wood form with preassembled nails. Align center line of dowel at mid-slab depth.
 4. Secure the joint assembly to form at top and back of each assembly bracket with two 8d duplex nails per bracket. For long runs, join joint assembly at overlap using nylon nuts and bolts provided.
 5. Check assembly for correct line and elevation and adjust if required. If the Armor-Edge® joint assembly will butt up to a saw-cut contraction joint, cut through the full depth (2") of the abutting bar to allow activation of the joint.
 6. Place and finish first slab. Use internal vibration to consolidate concrete under Diamond Dowel® pocket former in accordance with industry guidelines. Remove concrete paste from top of bars during finishing.
 7. Remove mounting bracket from joint assembly. Then strip form and bend nails that are protruding from pocket former so they are flush with joint face.
 8. Insert Diamond Dowel® plate into slot created by Diamond Dowel® pocket former. Center the corner of the plate in the middle of the label and push straight through the label into the pocket former. Do not hammer, or use excessive pounding force, to insert Diamond Dowel® plate. Diamond Dowel® plate should be inserted within two weeks of concrete placement.
 9. Place and finish second slab. Use internal vibration to consolidate concrete under plate in accordance with industry guidelines. Remove concrete paste from top of bars during finishing. Threads of nylon nut will strip when concrete contracts.
 10. Protect Armor-Edge® joint assemblies from displacement and from

damage until concrete casting is complete.

N. Installation of Armor-Edge® n2e joint assembly for new slab to existing slab:

1. Hold steel plate against existing slab, ensuring steel plate and bar are Revision – 3/02/07 3 flush with existing slab surface. Mark locations of holes for square dowels and anchor bolts with spray paint. Remove Armor-Edge® n2e joint assembly.
2. Drill holes for square dowels using 1 1/4" drill bit and for anchor bolts using a 1/2" drill bit. Attach joint assembly to existing slab with anchor bolts provided. Check assembly for correct line and elevation and adjust if necessary.
3. Epoxy grout 3/4" by 12" square dowels provided into pre-drilled holes. Allow epoxy to cure. Install square dowel clips with the plastic covering the top of the dowel and the side foam vertical to faces of bars. The plastic clip should extend the full length of the exposed dowel.
4. If the Armor-Edge® n2e joint assembly will butt up to a saw-cut contraction joint, cut through the full depth form (2") of the abutting bar to allow activation of the joint.
5. Remove steel shipping nut and washer.
6. Place and finish the new slab using internal vibration to consolidate concrete in accordance with industry guidelines.
7. Remove concrete paste from top of plate and bar during finishing.
8. If existing slab is uneven or out of level, grind joint flush. If this is not possible, saw-cut 1/2" deep, 18"-24" back into existing slab; chip existing slab down 1/2"-3/4" and top with approved epoxy topping materials.
9. Protect Armor-Edge® n2e joint assemblies from displacement and from damage until concrete casting is complete.

3.05 CONCRETE PLACEMENT

H. Comply with recommendations in ACI 304R, "Guide for Measuring, Mixing, Transporting, and Placing Concrete", for measuring, mixing, transporting, and placing concrete.

1. Maximum Placement Time: 90 minutes from batch time.

I. Verify proper placement of all embeds, anchor bolts, and similar items prior to concrete placement. Notify Engineer should there be a question concerning placement of these items.

J. Do not add water to concrete during delivery, at Project site, or during placement.

K. All beams shall be poured monolithically. Consolidate concrete with

mechanical vibrating equipment.

3.06 FINISHING FORMED SURFACES

- H. General: Finish formed surfaces as specified herein, unless otherwise indicated on Drawings.
 - 1. Provide floor flatness and floor levelness in accordance with Owner requirements.
- I. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
- J. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Completely remove fins and other projections.
 - 1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as painting.
 - 2. Do not apply rubbed finish to smooth-formed finish.
- K. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.
- L. Do not disturb surface paste covering Twisted Steel Micro Rebar (TSMR) reinforcement during finish operations.

3.07 FINISHING UNFORMED SURFACES

- H. General: Comply with ACI 302.1R, "Guide for Concrete Floor and Slab Construction", for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- I. Definitions:
 - 1. Ff defines the maximum floor curvature allowed over 24 inches computed on the basis of successive 12 inch elevation differentials, Ff is commonly referred to as the "Flatness F-Number."
 - 2. FI defines the relative conformity of the floor surface to a horizontal plan as measured over a 10-foot distance.
- J. Criteria:
 - 1. The entire slab-on-grade shall be designated as a Random Traffic

- Floor.
2. Slab-on-grade floor slabs shall conform to the following F-number requirements.
 - a. Specified Overall Value: Ff 55 / FI 38
 - b. Minimum Local Value: Ff 40 / FI 27
 3. General Conformity to Design Grade:
 - a. The slab-on-grade floor shall fall within +/- 3/4 inch of the finished floor elevation.
 4. Floor Tolerance Measurements: Floor flatness and levelness tests shall be conducted in accordance with the provisions set forth in ASTM E1155. Floor tolerance measurements shall be made 24 hours after completion of the final troweling operations – and in all cases before forms and/or shores have been removed – using an F-Meter as manufactured by Allen Face & Company of Wilmington, NC or other testing equipment specifically approved by the Owner. Results of all floor tolerance tests, including a formal notice of acceptance or rejection of the work, shall be provided to the Contractor within 24 hours after data collection. Weekends and holidays shall be ignored when computing the testing and reporting deadlines specified above.
 5. Each newly installed floor slab shall be subdivided into Minimum Local Floor Sections defined by either the column and half-column lines, or the construction and control joints, whichever subdivision yields the smaller area.
 6. Remedy for out-of-tolerance work: All Minimum Local Floor Sections measuring at or above both of the specified minimum local F-numbers shall be accepted for tolerance compliance as constructed. All Minimum Local Floor Sections measuring below either of the specified minimum local F-numbers shall be removed and replaced for slab-on-grade.
- K. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on the surface.
1. Do not further disturb surfaces before starting finishing operations.
- L. Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish.
- M. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, paint, or another thin film finish coating system.
- N. Nonslip Broom Finish: Apply a nonslip broom finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber- bristle broom perpendicular to main traffic route.

3.08 TOLERANCES

- H. Comply with ACI 117 "Specifications for Tolerances for Concrete Construction and Materials."

3.09 CONCRETE PROTECTION AND CURING

- H. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for "Cold-Weather Protection", and with recommendations in ACI 305R for "Hot-Weather Protection", during curing.
- I. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- J. Begin curing after finishing concrete, but not before free water has disappeared from concrete surfaces.
- K. Cure floor surfaces in accordance with ACI 308.
- L. Moist Curing of Interior Slab-on-Grade:
 - 1. All slab-on-grade floors shall be cured with a moisture protective cover installed immediately after the concrete has hardened and the control joints sawn. Install per manufacturer instructions.
 - 2. Wet surface of slab-on-grade with 1/8 to 1/4 inch of water over entire surface area of slab, then slowly unroll cover onto slab using a roller squeegee applicator. Smooth surface to eliminate wrinkles and insure uniform contact with slab surface.
 - 3. Lap ends and edges minimum of 6 inches.
 - 4. Maintain cover for not less than 7 days and protect from damage by equipment, temperature change, storage materials, curing procedures, rain and running water.
 - 5. Rewet as necessary.
- M. Membrane Curing Compound of all other concrete surfaces:
 - 1. The compound shall be applied uniformly over the entire surface in accordance with manufacturer's instruction.
 - 2. Moisture loss from absorption of forms shall be minimized by keeping forms wet until they can be safely removed.
 - 3. During curing period, the surfaces shall be protected from damage by equipment, temperature change, stored materials, curing procedures, rain and running water.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Tests will be performed according to ACI 301, "Specifications for Structural Concrete" and as specified herein.
- B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172, "Standard Practice for Sampling Freshly Mixed Concrete" shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - 2. Slump: ASTM C 143, "Standard Test Method for Slump of Hydraulic-Cement Concrete"; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C 231, "Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method", pressure method, for normal weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 4. Four-Cylinder Compressive Strength Tests: ASTM C 39, "Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens". Test one cylinder after 7 days, test two after 28 days and hold one in reserve.
 - 5. Verify reinforcement placement.

3.11 REPAIRS

- A. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.
- B. For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- C. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Owner's representative. Surface defects, as such, include color and texture

irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

- D. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
- E. Repair of Unformed Surfaces: Generally, no repair of concrete surface will be allowed. The exception to this will be minor damage caused by tilt-wall forms and braces attached to the slab. Concrete spalling or pull-up associated with inadequate bond breaker at tilt-up panels may not be patched. All damage deemed not to be patched by the owner must be removed to nearest control joint or construction joint and replaced. Rain damage during final finishing and troweling may not be patched. There is to be absolutely no dusting of surface with portland cement at any time.
- F. Repair finished unformed surfaces that contain defects which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets and other objectionable conditions. Re: section on appearance. Remove area to nearest control joints and replace.
- G. Drill holes from all formwork prior to patching with epoxy. Color to match adjacent surface.
- H. Epoxy all floor sawcut and construction joints. Color to match adjacent surface.
- I. Polyurethane all concrete pavement sawcuts and construction joints.
- J. Polyurethane all concrete sidewalk control joints.
- K. Polyurethane all concrete flatwork which abuts vertical surfaces.

END OF SECTION 03300

**SECTION 03350 INTERIOR
CONCRETE FLOOR SLABS
(Concrete Materials)**

PART 1 - GENERAL

1.01 CONCRETE MATERIALS

- A. Portland Cement: shall conform to ASTM C 150.
 - 1. From American made clinker.
 - 2. Type I per geotechnical report.
 - 3. Use same brand and source of cement throughout project.
 - 4. Minimum total cementitious materials content: 520 pounds per cubic yard of concrete.

1.02 CONCRETE AGGREGATES

- A. General:
 - 1. In accordance with ASTM C 33 with modification herein having precedence.
 - 2. Sieve analysis shall be current (conducted within the last three month), in accordance the ASTM C 136 and submitted with the mix design.
 - 3. The conformance with the combined aggregate graduation requirements (see Part 2 - Combined Aggregate Graduations) is of higher priority than meeting ASTM 33 aggregate graduation tolerances alone.
- B. Coarse Aggregate: In accordance with ASTM C33 - 467 (1-1/2" top size aggregate).
- C. Fine Aggregate:
 - 1. Individual fine aggregate graduations shall conform to ACI 302.1 table 4.2.1

SIEVE SIZE	PERCENT PASSING
3/8 in.	100
No. 4	95-100
No. 8	80-90
No. 15	50-75
No. 30	30-50
No. 50	10-20
No. 100	2-5

1.03 MIXING WATER

- A. Water shall be fresh, clean and potable.

1.04 MORTAR FRACTION

- A. Mortar Fraction shall be between 55 percent and 57 percent.
- B. The Mortar Fraction is the percent of all concrete mix material passing the No.8 sieve.

1.05 WATER/CEMENTITIOUS MATERIAL RATIO

- A. Ratio is not to exceed 0.55.

1.06 ADMIXTURES

- A. When requested, a local qualified concrete technician employed by the admixture manufacturer shall be available to assist in proportioning admixture dosage for optimum use, proper use of the admixture and adjustment of concrete mix proportions to meet jobsite and climatic conditions. Contractor shall give admixture manufacture's representative a minimum of 48 hours notice when job service is requested on the product.
- B. Water reducing admixture: shall conform to ASTM C 494 TYPE A.
 - 1. Product: "Pozzolith Normal Series" or "Polyheed Normal Series" by Master Builders, Inc.
- C. Midrange Water Reducing Admixture: Shall conform to ASTM C 494 Type A and Type F.
 - 1. Product: "Polyheed Series" by Master Builders, Inc.
 - 2. Added at a minimum dosage of 8 ounces per 100 pounds of cementitious material and shall provide a minimum of 8 percent water reduction and produce a concrete slump range of 4-6 inches. Normal setting times shall be maintained throughout the dosage range of the midrange water-reducing admixture. Amount of admixture used shall be in accordance with manufacturer's recommendations.

- D. Non-Corrosive, Non-Chloride Accelerator: ASTM C 494, Type C or E.
 - 1. Shall not contain more chloride ions than are present in municipal drinking water.
 - 2. Admixture manufacturer must have long term non-corrosive test data from an independent testing laboratory of at least one year duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.
- E. Air Entraining Admixture: ASTM C 260.
 - 1. No air entrainment admixture shall be used for steel trowel finished concrete.
 - 2. Total entrapped air content shall be no greater than 2 percent.

1.07 CONCRETE PLACEMENT

- A. All slab concrete shall be placed by pumping. No tail gating will be allowed.

PART 2 - COMBINED AGGREGATE GRADATIONS

2.01 COMBINED GRADATIONS (all aggregate in the concrete mix)

- A. Shall have between 8 and 18 percent retained on each sieve size below the 1-1/2 inch sieve and about the No. 50 sieve.
- B. The No. 30 and No. 50 sieves shall have 8 percent to 15 percent retained on each sieve.
- C. The 1-1/2 inch size sieve shall have 0 percent to 4 percent retained.
- D. The No. 100 sieve shall have 1.5 percent to 5 percent retained.
- E. Notes:
 - 1. Often, an additional intermediate size aggregate is required to achieve the above gradation requirements.
 - 2. Mixture proportions should be adjusted whenever individual aggregate grading varies during the course of the project.

2.02 ACCEPTED DEVIATIONS

- A. Accepted deviations from the above combined gradation requirements are as follows:
 - 1. Never shall three adjacent sieve sizes fall below 8 percent retained.
 - 2. If two consecutive sieve sizes fall below 8 percent retained, each shall have an adjacent sieve size with a retained percentage that is 4 percent greater (example: if both the #4 and # 8 sieves have 6 percent retained, the 3/8 inch and # 16 sieves should have a minimum of 10 percent retained).
 - 3. Never shall two adjacent sieve sizes fall below 5 percent retained.

2.03 COARSENESS FACTOR

- A. Coarseness factor shall be between 60 percent and 75 percent.
 - 1. The Coarseness Factor is the percent of the combined aggregate retained on the No. 6 sieve that is also retained on the 3/8 inch sieve.

2.04 WORKABILITY FACTOR

- A. Workability Factor shall be between 30 percent and 40 percent.
 - 1. The Workability Factor is the percent of all combined aggregate passing the No. 8 sieve.

PART 3 - PERFORMANCE

3.01 COMPRESSIVE STRENGTH

- A. As indicated

3.02 FLEXURAL STRENGTH

- A. 650 psi minimum 28 days.

3.03 MAXIMUM SLUMP

- A. 4 inches with Type A water reducing admixture.
- B. 6 inches with mid-range water reducing admixture.

END OF SECTION 03350

SECTION 03356
CONCRETE FLOOR FINISHING

PART 1 - GENERAL

1.01 SUMMARY

- A. Finishing slabs on grade and elevated slabs.
- B. Curing concrete surfaces.
- C. Surface treatment with concrete hardener.
- D. Crack repair of concrete floor slabs.
- E. Related Sections:
 - 1. Section 03300 "Cast-in-Place Concrete" for basic requirements for concrete slabs.

1.02 REFERENCES

- A. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International.
- B. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International.
- C. ACI 308 - Standard Practice for Curing Concrete; American Concrete Institute International.
- D. ASTM C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- E. ASTM C 171 - Standard Specification for Sheet Materials for Curing Concrete.
- F. ASTM E 1155 - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers.

1.03 SUBMITTALS

- A. Product Data: Provide data on all products, including information on compatibility of different products and limitations.

1.04 QUALITY ASSURANCE

- A. Interior Slab-on-Grade Installer: Construction of interior slab-on-grade shall be performed by Installer capable of achieving high quality control in finished product as measured in terms of surface flatness and levelness, uniformity in texture, smoothness, and appearance of hard steel troweled surfaces, precision in construction of joints, and minimization of slab shrinkage, cracking, and edge curling. Engage Installer, fully experienced in ways, means, methods and materials of slab-on-grade concrete construction, capable of producing high quality finished product for this project, and as acceptable to Owner.
- B. Perform Work in accordance with ACI 301 and ACI 302.1R.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.06 PROJECT CONDITIONS

- A. No satisfactory chemical or cleaning procedure is available to remove petroleum stains from the concrete surface. Prevention is therefore essential.
 - 1. No motorized vehicles will be allowed on slabs without proper protection for wheels and oil or hydraulic reservoirs to eliminate oil drips and avoid staining of the concrete.
 - 2. No trade will park vehicles on the inside slab.
 - 3. No pipe cutting machine will be used on the inside floor slab without adequate protection.
 - 4. Steel if placed on interior slabs shall be on dunnage over plastic sheeting to avoid rust staining.
- B. Maintain temperature of concrete above 40 degrees F. for seven days after placing. Protect work against frost, rapid drying and heavy rain.

PART 2 - PRODUCTS

2.01 MEMBRANE CURING COMPOUND

- A. Membrane Curing Compound: ASTM C 309 Type 1 - Clear or translucent, Class B. Moisture loss not more than 0.55 kg/sq. meter when applied at 200 sq. ft./gal. VOC compliant.
 - 1. L&M Cure R as manufactured by L & M Chemical Company, or approved equal.

2.02 MOIST CURING MATERIALS FOR SLAB ON GRADE

- A. Moisture-Retaining Sheet: ASTM C 171.
 - 1. McTech Group: UltraCure SUN, cellulose fabric with a 3 mil reflective impervious coating applied to one side.
 - 2. Water: Clean, potable free of alkali, not detrimental to concrete.

2.03 PENETRATING CONCRETE HARDENER

- A. Penetrating, chemically reactive, concrete hardener containing sodium silicate (minimum solids content of 20 percent of which 50 percent is silicate), equal to:
 - 1. Dayton Superior: Day-Chem Sure Hard J-17.
 - 2. Euclid: Diamond Hard.
 - 3. L & M: Seal Hard.
 - 4. Nox-Crete: Duro-Nox

2.04 CRACK REPAIR MATERIAL

- A. Two component, high penetration polyurethane for crack, spall, and surface repair of slab on grade.
 - 1. Roadware, Inc.: Roadware 10 Minute Concrete Mender.

2.05 CONCRETE BONDING AGENT

- A. Epoxy based adhesive for bonding to concrete surfaces:
 - 1. Dayton Superior: Sure-Anchor Epoxy J-50
 - 2. Euclid: Corr-Bond.
 - 3. L & M: Epobond.
 - 4. Nox-Crete: Acryl-Binder.
 - 5. Sonneborn: Sonobond.

2.06 CONCRETE PATCHING MATERIAL

- A. Epoxy and cement repair mortar allowing thin cross sections:
 - 1. Euclid: Eucocrete.
 - 2. L & M: Durapatch Industrial.
 - 3. Nox-Crete: Feather Patch.
 - 4. Sonneborn: Epolith Patcher.

2.07 EVAPORATION RETARDANT

- A. Acceptable Products:
 - 1. Dayton Superior: Sure Film.
 - 2. Euclid: Eucobar.
 - 3. L & M: E-Con.

4. Nox-Crete: Monofilm.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that floor surfaces are acceptable to receive the work of this section.

3.02 RANDOM TRAFFIC FLOORS

- A. Definitions:
 1. Ff defines the maximum floor curvature allowed over 24 inches computed on the basis of successive 12 inch elevation differentials, Ff is commonly referred to as the "Flatness F-Number."
 2. FI defines the relative conformity of the floor surface to a horizontal plane as measured over a 10-foot distance.
- B. Criteria:
 1. The entire slab-on-grade shall be designated as a Random Traffic Floor.
 2. Slab-on-grade floor slabs shall conform to the following F-number requirements.
 - a. Specified Overall Value for Each Individual Pour: Ff 55 / FI 38.
 - b. Minimum Local Value for Each Individual Pour: Ff 40 / FI 27.
 3. General Conformity to Design Grade:
 - a. The slab-on-grade floor shall fall within $\pm 3/4$ inch of the finished floor elevation.
 4. Floor Tolerance Measurements: Floor flatness and levelness tests shall be conducted in accordance with the provisions set forth in ASTM E1155. Floor tolerance measurements shall be made within 24 hours after completion of the final troweling operations - and in all cases before forms and/or shores have been removed - using an F-Meter as manufactured by Allen Face & Company of Wilmington, NC or other testing equipment specifically approved by the Owner. Results of all floor tolerance tests, including a formal notice of acceptance or rejection of the work, shall be provided to the Contractor within 24 hours after data collection. Weekends and holidays shall be ignored when computing the testing and reporting deadlines specified above.
 5. Each newly installed floor slab shall be subdivided into Minimum Local Floor Sections defined by either the column and half-column lines, or the construction and control joints, whichever subdivision yields the smaller area.

6. Remedy for out-of-tolerance work: All Minimum Local Floor Sections measuring at or above both of the specified minimum local F-numbers shall be accepted for tolerance compliance as constructed. All Minimum Local Floor Sections measuring below either of the specified minimum local F-numbers shall be removed and replaced for slab-on-grade.

3.03 SLAB FINISHES

- A. Deposit and consolidate concrete slabs, by pump only, in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
- B. Using laser screed, consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners. Do not over-vibrate surface.
- C. Bring slab surfaces to correct level with straightedge and strike-off. Use highway straightedge, bull float or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
- D. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Float surfaces on concrete in manner that will compact concrete and produce surface free of depressions or ridges. Test for grade or level and correct as necessary by removing excess or adding and compacting additional concrete. Surfaces to receive float finish include slabs to receive setting beds.
- E. Check and level surface plane to tolerance of 1/4" maximum deviation in 10 feet. Cut down high spots and fill low spots.
- F. Trowel finish: Apply a trowel finish to designated monolithic slab surfaces. After floating, begin first trowel finish operation using power-driven trowel. Begin final troweling when surface produces ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand troweling operation, free of trowel marks, uniform in texture and appearance. All interior slabs shall receive a hard steel trowel finish.
- G. Non-slip broom finish: Immediately after trowel finishing, roughen concrete surface by brooming in direction perpendicular to main traffic routes. Coordinate required final finish with Owner before application. Apply non-slip broom finish to all exterior concrete platforms, steps, pavement and ramps.

3.04 EVAPORATIVE RETARDANT

- A. When concrete slab placement are subject to high temperatures, wind and/or low humidity, the Contractor shall use the evaporation retarder to minimize plastic cracking. The compound may be required to be applied one or more times during the finishing operation. The initial application is usually made after the strike-off operation.

3.05 CONTROL JOINTS

- A. Locate control joints as indicated on the drawings. If joint pattern is not shown, provide joints not exceeding 3 times the slab thickness with the resultant value expressed in feet between joints. Locate to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
- B. All sawn control joints shall be made using the "Soff-Cut" method. Initial depth of joint with new blade shall be 1-1/4 inch. Minimum depth of joint accounting for blade wear shall be 3/4 inch. Saw joints immediately following the final finishing operation in accordance with recommendations of Soff-Cut. Replace saw blades at first sign of raveling at the joint. Guide plate shall be replaced each time a saw blade is replaced.

3.06 CURING

- A. Cure floor surfaces in accordance with ACI 308.
- B. Moist Curing of Interior Slab-on-Grade:
 - 1. All slab-on-grade floors shall be cured with a moisture protective cover installed immediately after the concrete has hardened and the control joints sawn. Install per manufacturer instructions.
 - 2. Wet surface of slab on grade with 1/8 to 1/4 inch of water over entire surface area of slab, then slowly unroll cover onto slab using a roller squeegee applicator. Smooth surface to eliminate wrinkles and insure uniform contact with slab surface.
 - 3. Lap ends and edges minimum of 3 inches.
 - 4. Maintain cover for not less than 7 days and protect from damage by equipment, temperature change, stored materials, curing procedures, rain and running water.
 - 5. Rewet as necessary.
- C. Membrane Curing Compound of all other concrete surfaces:
 - 1. The compound shall be applied uniformly over the entire surface in accordance with manufacturer's instruction.
 - 2. Moisture loss from absorption of forms shall be minimized by keeping forms wet until they can be safely removed.

3. During curing period, the surfaces shall be protected from damage by equipment, temperature change, stored materials, curing procedures, rain and running water.

3.07 PENETRATING CONCRETE HARDENER

- A. The hardener shall be applied immediately after removal of moist curing blankets and before any traffic is permitted on the slab.
- B. Application: Follow the manufacturer's written instructions for the application of the hardener.
 1. The manufacturer's technical representative shall be present at the initial application to observe the work and provide technical assistance.
 2. It is critical that the dust or slurry from saw cutting of floor joints be thoroughly removed from the slab prior to application.
 3. Application shall be made with a low-pressure sprayer with enough coverage to keep concrete surface wet with material for 30 to 45 minutes (approximately 200 square feet per gallon). No spot or area on the slab should be allowed to become dry during this period.
 4. After this period, when the treated surfaces become slippery under foot, lightly sprinkle the surface with water and agitate with a broom to redistribute the material evenly across the surface.
 5. After the surface becomes slippery again, use hose with pressure nozzle to pressure flush the entire surface with water in order to remove excess material, alkali, or impurities. Squeegee or wet-vac the surface completely dry.
 6. If certain areas are still slick during the squeegee operation, it will be necessary to re-flush and re-squeegee until the entire slab area is free from the material residue. The concrete should appear as though there is nothing on it.
- C. Immediately prior to Substantial Completion, apply reapplication coat to all areas scheduled to receive sealer/hardener.
 1. Preparation of Surfaces: Surfaces shall be power washed and properly prepared to remove all loose dirt, oil, non-compatible curing compounds, bond breakers, and other foreign matter. Surface shall be clean and dry prior to application of the hardener.
 2. Application: Follow manufacturer's written instructions for the reapplication coat application.
- D. Entire floor surfaces that receive a penetrating hardener shall be machine power buffed to a low sheen, at Substantial Completion.

3.08 PROTECTION

- A. Where other concrete structures are to be poured on top of or adjacent to finished surfaces, take all necessary precautions to prevent damage from erection of formwork or staining from concrete laitance.
- B. Alert other trades to the need for special protection against rolling or sliding heavy loads across the surface, oil drippings from pipe threaders, spillage of paint, plaster and mortar. Insure that the covering is not damaged or removed during the progress of the work.
- C. Review proposed tilt panel construction and erection procedures to ensure that scratching, marring, gouging, and cracking of the floor slabs will be avoided.

3.09 CRACK REPAIR OF FLOOR SLABS

- A. General: Repair all cracks that meet the requirements set out in this specification. Cracks that do not meet these requirements do not need to be repaired.
- B. Coordination: Repairs made after the Owner moves in shall be made at times that do not interfere with regular warehouse activities.
- C. Repair those cracks that meet any of the following conditions:
 - 1. The crack is wider than 1/ 32 inch (i.e. "credit card width").
 - 2. The crack edges have begun to spall.
 - 3. Adjacent slab elements (on either side of the crack) exhibit vertical movement when crossed by a loaded lift.
- D. Method of Repair: Follow these steps (or use other method acceptable to the Owner):
 - 1. Multiple cracks clustered in a spider web appearance:
 - a. Remove concrete slab forming a rectangular area normal to column grid. Extend rectangular area to the nearest control or construction joint.
 - b. Place and finish new concrete with same specifications as original slab. All edges shall be doweled into existing slab using 3/4" diameter x 12" long smooth steel dowels at 18" on-center. Dowels shall be placed centered in slab, with half the dowel drilled and placed into existing slab.
 - 2. All other isolated cracks:
 - a. Surface Spalls and Deflections: Remove all loose materials back to sound concrete with a chisel or light chipper. Use a wire brush or twisted wire wheel to clean the repair area.
 - b. Surface Cracks: Clean out the crack with compressed air,

- high pressure water blast or wire brush.
- c. All surfaces must be free of dirt, oils, dust, latents and old repair materials.
 - d. In accordance with manufacturer's recommendations, overfill the crack at all locations to at least 1/3 the slab's depth using Roadware 10 Minute Concrete Mender.
 - e. Clean, fine sand may be used both to extend the product and to prevent bottom leakage in the wider cracks.
 - f. Multiple injections passes may be required to ensure that the crack filler is left higher than the adjacent concrete at all locations.
 - g. After the filler has hardened, grind/polish the joint flush with the surrounding surface, providing a smooth and seamless repair.

3.10 FIELD QUALITY CONTROL

- A. An independent testing agency, as specified in Section 01400, will inspect finished slabs for flatness and levelness.

END OF SECTION 03356

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SECTION 03470

TILT-UP PRECAST CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section specifies tilt-up concrete panels, including the following:
 - 1. Monolithic panels.
- B. Refer to Drawings for the following:
 - 1. Panel thickness and reinforcing.
 - 2. Chamfers, reveals, and similar features.
- C. Related Sections include the following:
 - 1. Section 033000 "Cast-in-Place Concrete" for general concrete construction.

1.02 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Shop Drawings: Detail fabrication and installation of tilt-up precast concrete units. Indicate panel locations, plans, elevations, dimensions, shapes, cross sections, and details of steel embedments, pockets, reveals, and openings. All submittals to be signed and sealed by a licensed Engineer.
 - 1. Include steel reinforcement, detailing fabrication, bending, and placing. Include material, grade, bar schedules, stirrup spacing, bent-bar diagrams, arrangement, and supports of concrete reinforcement.
 - 2. Include additional steel reinforcement to resist hoisting and erection stresses.
 - 3. Include locations and details of hoisting points and lifting devices for handling and erection. Signed and sealed lift book required.
 - 4. Include engineering analysis data of additional steel reinforcement, hoisting, erection and bracing details, signed and sealed by the qualified professional engineer responsible for their preparation.

5. Indicate welded connections by AWS standard symbols. Detail cast-in inserts, connections, and joints, including accessories.
- D. Welding Certificates: Copies of certificates for welding procedures and personnel.
- E. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated, based on comprehensive testing of current materials:
1. Cementitious materials and aggregates.
 2. Steel reinforcement.
 3. Admixtures.
 4. Curing compounds.
 5. Inserts and embedments.
- F. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
1. Cementitious materials and aggregates.
 2. Steel reinforcement.
 3. Admixtures.
 4. Curing compounds.
 5. Inserts and embedments.
- G. Pre-Panel Pour Meeting:
1. Schedule and administer pre-panel pour meeting prior to placing formwork in first tilt-up panels.
 2. Attendance Required:
 - a. Owner's Representative
 - b. Structural Engineer
 - c. Material Testing Agency's Field Representative.
 - d. Contractor's Project Manager and Superintendent.
 - e. Tilt Panel Erection Sub-Contractor
 - g. Concrete Supplier, Concrete Consultant
 - h. Others as appropriate
 3. Suggested Agenda:
 - a. Formwork
 - b. Reinforcement
 - c. Reveals and rustification components
 - d. Erection procedures
 - e. Safety
 4. Record minutes and distribute copies within two days after meeting to participants, copies to Architect, Owner, participants and those affected by decisions made.
- H. All shop drawings shall be signed and sealed by a North Carolina licensed engineer.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed tilt-up precast concrete 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.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of North Carolina and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for tilt-up precast concrete installations that are similar to those indicated for this Project in material, design, and extent.
- C. Concrete Manufacturer Qualifications: A firm complying with ASTM C 94, "Standard Specification for Ready-Mixed Concrete", requirements for production facilities and equipment.
 - 1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's "Certification of Ready Mixed Concrete Production Facilities."
- D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077, "Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation", and ASTM E 329, "Standard Specification for Agencies Engaged in Construction Inspection and/or Testing", to conduct the testing indicated, as documented according to ASTM E 548, "Standard Guide for General Criteria Used for Evaluating Laboratory Competence".
- E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- F. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1 "Structural Welding Code--Steel."
 - 2. AWS D1.4 "Structural Welding Code--Reinforcing Steel."
- G. ACI Standard: Comply with ACI 301 "Specification for Structural Concrete," unless more stringent provisions are indicated.
 - 1. ACI 117 "Specifications for Tolerances for Concrete Construction and Materials."

PART 2 - PRODUCTS

2.01 FORMS AND ACCESSORIES

- A. Forms: Metal, dressed lumber, or other approved materials that are nonreactive with concrete and that will provide continuous, true, and smooth concrete surfaces.
- B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch.
- C. Reveal Strips: Straight wood strips, dressed, with sides beveled.
- D. Sealer: Penetrating, clear, polyurethane wood form sealer formulated to reduce absorption of bleed water and prevent migration from wood of set-retarding chemicals.

2.02 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, "Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement", Grade 60, deformed.
- B. Plain Steel Wire: ASTM A 82, "Standard Specification for Steel Wire, Plain, for Concrete Reinforcement", galvanized.
- C. Plain Steel Welded Wire Fabric: ASTM A 185, "Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete", fabricated from as-drawn steel wire into flat sheets.
- D. Bar Supports: Manufacture according to CRSI's "Manual of Standard Practice," of plastic.

2.03 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, "Standard Specification for Portland Cement", Type I.
- B. Normal Weight Aggregates: ASTM C 33, "Standard Specification for Concrete Aggregates", uniformly graded, and as follows:
 - 1. Class: Severe weathering region, but not less than 4S.
 - 2. Nominal Maximum Aggregate Size: 3/4 inch.
- C. Water: Potable and complying with ASTM C 94, "Standard Specification for Ready-Mixed Concrete".
- D. Chemical Admixtures: Certified by manufacturer to contain not more than

0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

1. Air-Entraining Admixture: ASTM C 260, "Standard Specification for Air-Entraining Admixtures for Concrete".
2. Water-Reducing Admixtures: ASTM C 494, "Standard Specification for Chemical Admixtures for Concrete", Type A.
3. High-Range, Water-Reducing Admixture: ASTM C 494, "Standard Specification for Chemical Admixtures for Concrete", Type F.
4. Water-Reducing and Accelerating Admixture: ASTM C 494, "Standard Specification for Chemical Admixtures for Concrete", Type E.
5. Water-Reducing and Retarding Admixture: ASTM C 494, "Standard Specification for Chemical Admixtures for Concrete", Type D.

2.04 BONDBREAKERS

- A. Waterborne, Chemically Reactive Bondbreaker: Penetrating polymerized emulsion containing no oils, waxes, paraffins, or silicones. Subject to compliance with requirements, provide one of the following products:
1. "Super Tilt WB Bond Breaker"; The Burke Group, LLC.
 2. "Conspec CST WB"; Conspec Marketing & Manufacturing Co., Inc.
 3. "Sure-Lift WB"; Dayton Superior Corporation.
 4. "Maxi Tilt E"; Richmond Screw Anchor Co.
 5. "Full Tilt E"; Symons Corporation.

2.05 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. McTech Group Ultracure Sun.

2.06 CONNECTION MATERIALS

- A. Embedded Items and Loose Hardware: Furnishing of embedded metal items and loose hardware for securing tilt-up precast concrete panels together and to supporting and adjacent construction is specified

elsewhere.

- B. Carbon Steel Shapes and Plates: ASTM A 36.
- C. Carbon Steel Bolts and Studs: ASTM A 307, Grade A; carbon steel, hex-head bolts and studs; carbon steel nuts; and flat, unhardened steel washers.
- D. Unheaded Carbon Steel Rods and Nuts: ASTM A 36, threaded rods with ASTM A 563, nuts.
- E. Welded Headed Studs: AWS D1.1, "Structural Welding Code - Steel", Type B headed studs, cold-finished carbon steel bars.
- F. Welding Electrodes: Comply with AWS standards.
- G. Hot-Dip Galvanized Finish: Apply zinc coating to steel connections by hot-dip process, complying with ASTM A 123, "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products", or ASTM A 153, "Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware", as applicable.
 - 1. Zinc Repair Paint: ASTM A 780, "Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings",
- H. Shop-Primed Finish: Prepare surfaces of steel connections, except those surfaces to be embedded in concrete, according to requirements of SSPC-SP 3, and shop apply primer according to SSPC-PA 1.
 - 1. Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664.

2.07 LIFTING INSERTS AND ACCESSORIES

- A. Furnish inserts, dowels, bolts, nuts, washers, and other items to be cast in panels for tilting and lifting.
 - 1. Manufacture inserts with feet of plastic, galvanized steel wire, plastic-tipped steel wire, or stainless-steel-tipped steel wire.
- B. Furnish brace anchors and other accessories to be cast in panels and in casting slab for attaching bracing.
 - 1. Manufacture wall brace anchors and accessories with feet of galvanized steel wire, plastic-tipped steel wire, or stainless-steel-tipped steel wire.

2.08 BEARING PADS

- A. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore A durometer, minimum tensile strength 2250 psi per ASTM D 412, "Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension".

2.09 GROUT MATERIALS

- A. Cement Grout: Portland cement, ASTM C 150, "Standard Specification for Portland Cement", Type I; and clean, natural sand, ASTM C 404. Mix at ration of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration. Minimum 4500 psi.
- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents; complying with ASTM C 1107, "Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation", of consistency suitable for application, and a 30-minute working time. Minimum 5000 psi.

2.10 RELATED MATERIALS

- A. Form Retarder: Chemical liquid set retarder, for application on hardened horizontal concrete and capable of temporarily delaying final hardening of newly placed concrete to depth of reveal specified.
 - 1. Mold Release: Solution specially formulated by manufacturer for use under form retarder.

2.11 REPAIR MATERIALS

- A. Portland cement, polymer, ultra-fine aggregates and mixed to a uniform creamy paste.
 - 1 Dayton Superior: Architectural Finish
 - 2 Nox-Crete: Panel Patch
 - 3 CTS Cements: Rapid Set WunderFixx

2.12 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mixes or field experience. Proportion normal-weight concrete according to ACI 211.1, "Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete", and ACI 301, "Specifications for Structural Concrete".

- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.
- C. Normal Weight Concrete: Proportion normal weight concrete mix as follows:
 - 1. Compressive Strength (28 Days): As indicated on the drawings.
 - 2. Maximum Water-Cementitious Materials Ratio: As indicated on the drawings.
 - 3. Maximum Slump: 4 inches plus or minus 1 inch at the point of delivery.
 - 4. Maximum Slump for Concrete Containing High-Range, Water-Reducing Admixture: 8 inches plus or minus 1 inch at the point of delivery after admixture is added to concrete with 2- to 4-inch slump.
- D. Air Content: Add air-entraining admixture at manufacturer's recommended rate to result in concrete at point of placement as indicated.
- E. Limit water-soluble chloride-ion content in hardened concrete as indicated.
- F. Admixtures: Use admixtures according to manufacturer's written instructions.

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, "Standard Specification for Ready-Mixed Concrete", and furnish batch ticket information.
 - 1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 90 to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site-Produced Concrete: Measure, batch, and mix concrete according to ASTM C 94, "Standard Specification for Ready-Mixed Concrete". Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For mixers of capacity 1 cu. yd. or smaller, mix at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before releasing any part of batch.
 - 2. For mixers of capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
 - 3. Provide a batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record panel locations where concrete is deposited.

PART 3 - EXECUTION

3.01 FORMS

- A. Construct and brace formwork so tilt-up precast concrete panels are of size, shape, alignment, elevation, and position indicated.
 - 1. Construct forms on slab-on-grade or on temporary casting slab, at Contractor's option.
 - 2. Provide for openings, offsets, recesses, reveals, rustications, reglets, and blockouts.
- B. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Kerf wood inserts, such as those forming reglets, rustications, and recesses, for easy removal.
- C. Set edge forms for panels to achieve required panel thickness.
- D. Chamfer exposed corners and edges, unless otherwise indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform, smooth lines and tight edge joints.
- E. Coat contact surfaces of wood forms and chamfers with sealer before placing reinforcement.
- F. Forms shall be set with glue instead of nails when possible.

3.02 BONDBREAKERS

- A. Product shall be a non-staining, bond breaker compatible with the curing compound and sealer/hardeners specified in Section 03356. Where required by local authorities, provide low VOC compatible products. Contractor shall assume all responsibility for properly preparing floor slab to receive sealer or sealer/hardeners.
 - 1. Burke: Clean Lift 90
 - 2. Conspec: Tilt-Eez
 - 3. Dayton Superior: Sure-Lift J-5 or J-6
 - 4. Richmond: Maxi Tilt E
 - 5. Nox-Crete: Silcoseal 2000F
- B. Uniformly and continuously apply two coats of bondbreaker to casting slab surfaces by power spray or roller according to manufacturer's written instructions, before placing steel reinforcement. Recoat areas subjected to moisture before drying. Maintain continuity of coating until concrete placement.
- C. After placing steel reinforcement, touch up or recoat worn or damaged

areas with bondbreaker. Do not splash or coat steel reinforcement and inserts.

3.03 REINFORCEMENT AND INSERTS

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating and placing reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 - 1. Field weld reinforcement according to AWS D1.4, "Structural Welding Code--Reinforcing Steel", where indicated.
 - 2. Do not tack-weld crossing reinforcing bars.
 - 3. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- C. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- D. Accurately place and securely support embedded items, anchorages, inserts, cramps, retainers, bar chords and sleeves, and other items to be built into panels. Coordinate with other trades for installing cast-in items.

3.04 PANEL CASTING, GENERAL

- A. Comply with ACI 301, "Specifications for Structural Concrete", for handling, placing, and consolidating concrete.
- B. Maintain position of steel reinforcement, inserts, and anchors during concrete placement, consolidation, and finishing. Concrete to be pumped only.
- C. Screed panel surfaces to correct level with a straightedge and strike off.
 - 1. Begin initial floating before excess moisture or bleed water appears on the surface. Use bull floats or darbies to form a uniform and open-textured surface plane free of humps or hollows. Do not disturb panel surfaces before beginning finishing operations.
- D. Form chamfers at top edges of panel perimeters, openings, and similar locations not formed by chamfer strips, unless otherwise indicated.

3.05 CASTING TOLERANCES

- A. Cast tilt-up precast concrete panels without exceeding the following

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Dunn, NC

Tilt-Up Precast Concrete
03470-10

tolerances:

1. Height and Width of Panels: As follows:
 - a. Up to 20 Feet: 1/4 inch.
 - b. 20 to 30 Feet: 5/16 inch.
 - c. Each Additional 10 Feet in Excess of 30 Feet: 1/8 inch.
2. Thickness: 3/16 inch.
3. Location and Size of Openings Cast into Panel: 1/4 inch.
4. Skew of Panel or Opening: Difference in length of diagonals of 1/8 inch per 72 inches with a maximum difference of 1/2 inch.
5. Location and Placement Tolerances of Embedded Items:
 - a. Inserts, Bolts, Pipe Sleeves: 3/8 inch.
 - b. Lifting and Bracing Inserts: 1/2 inch.
 - c. Lateral Placement of Weld Plates: 1 inch.
 - d. Tipping and Flushness of Weld Plates: 1/4 inch.
6. Deviation of Steel Reinforcement Cover: 3/8 inch, maintaining minimum cover required by ACI 301, "Specifications for Structural Concrete",

3.06 FACE-UP FINISHES

- A. Float Finish: Consolidate surface of plastic concrete with power-driven floats or by hand floating. Restraighten and cut down high spots and fill low spots. Repeat float passes and restraighten until surface is left with a uniform, smooth, granular texture.
- B. Trowel Finish: After applying float finish, apply first trowel finish and consolidate plastic concrete by hand trowel or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and is uniform in texture and appearance.

3.07 FACE-DOWN FINISHES

- A. Smooth, As-Cast Finish: Cast panel to produce a surface free of pockets, sand streaks, and honeycombs. Produce a surface appearance of uniform color and texture.

3.08 CONCRETE PROTECTION AND CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures according to ACI 301, "Specifications for Structural Concrete",
 1. Apply evaporation retarder in hot, dry, and windy weather to protect concrete from rapid moisture loss before and during finishing operations. Apply according to manufacturer's instructions after screeding and bull floating concrete, but before float finishing.

- B. Begin curing immediately after finishing concrete. Cure by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12 inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.09 ERECTION

- A. Use erection equipment with care to prevent damage to floor slabs and panels.
- B. Lift, support, and erect panels only at designated lifting or supporting points indicated on shop drawings.
- C. Do not erect panels until at least 2500 psi, or 75 percent of specified 28-day compressive strength, whichever is greater, has been verified.
- D. Install tilt-up precast concrete panels level, plumb, square, and true. Place panels on leveled grout setting pads or shims in correct position. Maintain following joint width between panels:
 - 1. 1/2 inch.
- E. Temporarily brace and support panels securely in position against loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to panels are secured.
- F. Anchor panels in place and, if indicated, to one another.
 - 1. Weld steel connectors to steel supports and embedments indicated, complying with AWS D1.1, "Structural Welding Code-- Steel".

- G. Solidly grout-fill gaps between foundation system and bottom of panels.

3.10 ERECTION TOLERANCES

- A. Install tilt-up precast concrete panels without exceeding the following erection tolerances:
 - 1. Exterior Face Width of Joints: As follows:
 - a. For Panels up to 20 Feet: 1/4 inch.
 - b. Each Additional 10 Feet in Excess of 20 Feet Tall: 1/8 inch.
 - 2. Joint Taper: Maximum 3/8 inch for entire length but not greater than the following:
 - a. For Panels up to 20 Feet Tall: 1/4 inch.
 - b. Each Additional 10 Feet in Excess of 20 Feet Tall: 1/8 inch.
 - 3. Alignment of Horizontal and Vertical Joints: 1/4 inch.
 - 4. Offset in Exterior Face of Adjacent Panels: 1/4 inch.

3.11 FILLING AND REPAIRS

- A. Patch holes and voids left by erecting and bracing inserts on tilt-up panels and slabs-on-grade. Cut or chip edges of voids perpendicular to concrete surface. Fill blockouts where indicated.
 - 1. Clean, dampen with water, and brush-coat holes, voids, and blockouts with bonding agent. Fill and compact with patching mortar of a stiff consistency before bonding agent has dried.
 - 2. Finish surfaces of fills and repairs to Owner's approval, with materials of same colors and textures as finishes on surrounding surfaces.
- B. Repair damaged galvanized steel surfaces of connectors by cleaning and applying a coat of zinc repair paint.
- C. Repair damage to tilt-up panels and slabs-on-grade, resulting from tilt-up work as directed by Owner.
- D. Remove and replace tilt-up panels that do not meet requirements of this Section.

3.12 CLEANING

- A. Pressure wash interior side of tilt-up panels prior to turnover.

END OF SECTION 03470

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SECTION 04810

CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Concrete masonry.
 - 2. Reinforced masonry.

1.02 REFERENCES

- A. American Concrete Institute/ACI International (ACI):
 - 1. ACI 315: Details and Detailing of Concrete Reinforcement.
- B. ASTM International (ASTM):
 - 1. ASTM A 153: Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - 2. ASTM A 615: Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 3. ASTM A 641: Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - 4. ASTM C 90: Specification for Loadbearing Concrete Masonry Units.
 - 5. ASTM C 91: Specification for Masonry Cement.
 - 6. ASTM C 144: Specification for Aggregate for Masonry Mortar.
 - 7. ASTM C 150: Specification for Portland Cement.
 - 8. ASTM C 177: Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
 - 9. ASTM C 207: Specification for Hydrated Lime for Masonry Purposes.
 - 10. ASTM C 270: Specification for Mortar for Unit Masonry.
 - 11. ASTM C 404: Specification for Aggregates for Masonry Grout.
 - 12. ASTM C 476: Specification for Grout for Masonry.
 - 13. ASTM C 1142: Specification for Extended Life Mortar for Unit Masonry.
 - 14. ASTM D 1752: Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
 - 15. ASTM D 2000: Classification System for Rubber Products in Automotive Applications.

- 16. ASTM E 514: Test Method for Water Penetration and Leakage Through Masonry.
- C. Underwriters Laboratories, Inc. (UL):
 - 1. UL 618: Concrete Masonry Units.

1.03 PERFORMANCE REQUIREMENTS

- A. Provide concrete masonry units with net compressive test strength as per drawings.
- B. Provide concrete masonry units that develops an installed compressive strength (f'm) as per drawings at 28 days, based on net area.
- C. General Conformance Standard: ACI 530.1 "Specification for Masonry Structures."

1.04 SUBMITTALS

- A. Product Data: For each different masonry unit, accessory, and other manufactured products specified.
- B. Shop Drawings: For reinforcing detailing fabrication, bending, and placement of masonry reinforcing bars. Comply with ACI 315 showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of masonry reinforcement.
- C. Samples: Full-size samples of finish concrete masonry units, and a 4 foot by 4 foot mockup.
- D. Material Certificates: For the following, signed by manufacturer and Contractor, certifying that each material complies with requirements.
 - 1. Each different cement product required for mortar and grout, including name of manufacturer, brand and type.
 - 2. Each material and grade indicated for reinforcing bars.
 - 3. Each type and size of joint reinforcement.
 - 4. Each type and size of metal accessories.
- E. Mix Designs: Proposed mortar mix designs.

1.05 QUALITY ASSURANCE

- A. Masonry inspections shall be provided per ACI 530, "Building Code Requirements & Specifications for Masonry Structures".

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Concrete Masonry Units:
 - 1. Store units above ground on level platforms which allow air circulation under stacked units.
 - 2. Cover with heavy weatherproof coverings to prevent staining by weather, dirt, mud, oils, and grease.
 - 3. Carefully handle units to prevent chipping, spalling, cracking, and any other condition which could impair strength, durability, or appearance of units.
 - 4. Discard and remove damaged units from Project site.
- B. Mortar and Masonry Grout:
 - 1. Deliver cementitious materials to Project site in manufacturer's original unopened containers.
 - 2. Store lime and cement in waterproof sheds or enclosures. Do not use materials damaged by water, moisture, or extended storage.
 - 3. Protect aggregates from dampness, freezing, and damage by inclusion of foreign substances.

1.07 PROJECT CONDITIONS

- A. Protection:
 - 1. Protect partially completed masonry against weather, when work is not in progress, by covering top of walls with strong, waterproof, nonstaining membrane.
 - a. Extend membrane at least 2 feet down both sides of walls and anchor securely in place.
- B. Environmental Requirements:
 - 1. Do not lay masonry when temperature is below 32 deg F when temperature is rising or below 40 deg F when temperature is falling, unless adequate precautions are taken to prevent work from

- freezing.
2. During freezing or near freezing weather, provide adequate equipment or cover to protect completed portions of Work and maintain minimum temperatures above 50 deg F.

PART 2 - PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. General: Provide shapes indicated and as follows for each form of concrete masonry unit required.
 1. Provide special shapes for stretchers, lintel and bond beams, closed end partition units, and other shapes indicated or required.
 2. Provide bullnose profile corners as indicated on Drawings.
- B. Concrete Masonry Units: ASTM C 90 and as follows:
 1. Weight Classification: Lightweight
 2. Provide Type II, nonmoisture-controlled units.
 3. Sizes: Nominal face dimensions of 8 inches by 16 inches; thicknesses as indicated.
 4. Exposed Faces: Manufacturer's standard color and texture, unless otherwise specified.

2.02 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II; maximum 0.6 percent alkali. Provide natural color.
- B. Masonry Cement: ASTM C 91, nonstaining. 22 percent maximum air content by volume and properties complying with requirements of ASTM C 270, Table 2, Type S mortar.
- C. Hydrated Lime: ASTM C 207, Type S.
- D. Aggregate for Mortar: ASTM C 144. Clean, dry, and washed free of salts.
- E. Aggregate for Grout: ASTM C 404. Size #1 for fine grout; Size #8 for coarse grout when minimum horizontal dimension of grouting space exceeds 4 inches.
- F. Ready-Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in this Article; combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C 1142. Permissible for use subject to approval by Architect for compliance with required compressive strength characteristics.

- G. Water: Clean, fresh, and potable.

2.03 REINFORCING STEEL

- A. Steel Reinforcing Bars: Material and grade as follows:
1. Billet steel complying with ASTM A 615.
 2. Grade 60.

2.04 JOINT REINFORCEMENT

- A. General: Provide joint reinforcement formed from the following:
1. Galvanized carbon steel wire, coating class as follows:
 - a. ASTM A 641, Class 1, for interior walls; and ASTM A 153, Class B-2, for exterior walls.
- B. Description: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet, with prefabricated corner and tee units, integral drips, and complying with requirements indicated below:
1. Wire Diameter for Side Rods: 0.1483 inch.
 2. Wire Diameter for Cross Rods: 0.1483 inch.
- C. For single-wythe masonry provide type as follows with single pair of side rods:
1. Truss design with continuous diagonal cross rods spaced not more than 16 inches o.c. **(NO SUBSTITUTIONS)**
- D. Products/Manufacturers: One of the following:
1. "Blok-Trus"; AA Wire Products Company.
 2. "Truss Type"; Dur-O-Wal, Inc.
 3. "Truss Type Block Mesh"; National Wire Products Corp.

2.05 ANCHORAGE DEVICES

- A. Dovetail Anchors: Masonry to concrete:
1. Slots: Standard 1 inch wide by 1 inch deep with 5/8 inch throat. Minimum 24 gauge galvanized steel. Provide one of the following:
 - a. "AA100"; AA Wire Products Company.
 - b. "D/A 100"; Dur-O-Wal, Inc.
 - c. "500 Series"; National Wire Products Corporation.
 2. Anchors: 3-1/2 inches long by 1/4 inch diameter galvanized wire.
 - a. "AA200"; AA Wire Products Company.
 - b. "D/A 720-723"; Dur-O-Wal, Inc.
 - c. "506 Series"; National Wire Products Corporation.

2.06 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: One of the following, complying with ASTM D 1752; felt or impregnated asphalt board type fillers are not acceptable:
 - 1. "Cork Expansion Joint"; Burke Company.
 - 2. "Horn Cork Expansion Joint"; A.C. Horn, Inc.
 - 3. "Tex-Cork"; J & P Petroleum Products, Inc.
 - 4. "Sealtight Cork"; W.R. Meadows, Inc.
 - 5. "Sonoflex Cork Expansion Joint"; Sonneborn-Contech.
- B. Premolded Control Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
 - 1. Styrene-butadiene rubber compound complying with ASTM D 2000, Designation M2AA-805.
 - 2. Products/Manufacturers: One of the following:
 - a. "Titewall AA1000"; AA Wire Products Co.
 - b. "D/A 2005"; Dur-O-Wal, Inc.
 - c. "Regular"; Ty-Wal.

2.07 MASONRY CLEANERS

- A. Job-Mixed Detergent Solution: Solution of 1/2 cup dry measure tetrasodium polyphosphate and 1/2 cup dry measure laundry detergent dissolved in 1 gal. of water.

2.08 MORTAR AND GROUT MIXES

- A. General: Do not add admixtures, including pigments, air-entraining agents, accelerators, retarders, water repellent agents, anti-freeze compounds, or other admixtures, unless otherwise specified.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, in order to ensure that mortar color is consistent.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for types of mortar indicated below:
 - 1. Limit cementitious materials in mortar to portland cement-lime.
 - 2. Exterior and Loadbearing Masonry: Type S.
 - 3. Interior and Non-Loadbearing Masonry: Type N.
 - 4. Pouring Grout: Type O.

- C. Grout for Unit Masonry: Comply with ASTM C 476, "Standard

Specification for Grout for Masonry". Use grout of consistency indicated or, if not otherwise indicated, of consistency (fine or coarse) at time of placement that will completely fill spaces intended to receive grout.

1. Compressive Strength: 3000 psi at 28 days.
2. Aggregate Size: 3/8 inch.
3. Slump: 8 to 10 inches.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of unit masonry. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

3.02 INSTALLATION, GENERAL

- A. Thickness: Build single-wythe walls to the actual thickness of the masonry units, using units of thickness indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Cut masonry units using motor-driven saws to provide clean, sharp, unchipped edges.

3.03 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: Do not exceed 1/4 inch in 10 feet, nor 3/8 inch in 20 feet, nor 1/2 inch in 40 feet or more.
- B. Variation from Level: Do not exceed 1/4 inch in 20 feet, nor 1/2 inch in 40 feet or more.
- C. Variation of Linear Building Line: Do not exceed 1/2 inch in 20 feet, nor 1/2 inch in 40 feet or more.
- D. Variation in Cross-Sectional Dimensions: Do not exceed minus 1/4 inch nor plus 1/2 inch from wall thickness indicated.

3.04 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to accurately locating of openings, movement-type joints, returns and offsets. Avoid the use of less-than-half-size units at corners, jambs and where possible at other locations.
- B. Lay walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.
- C. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4 inch horizontal face dimensions at corners or jambs.
 - 1. One-half running bond with vertical joint in each course centered on units in courses above and below.
- D. Stopping and Resuming Work: In each course, rake back 1/2-unit length for one-half running bond; do not tooth. Clean exposed surfaces of set masonry and remove loose masonry units and mortar prior to laying fresh masonry.
- E. Built-in Work: As the construction progresses, build-in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.
 - 1. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
 - 2. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, and similar items, unless otherwise indicated.
- F. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above and as follows:
 - 1. Install compressible filler in joint between top of partition and underside of structure above.

3.05 MORTAR BEDDING AND JOINTING

- A. Lay hollow concrete masonry units as follows:
 - 1. With full mortar coverage on horizontal and vertical face shells.
 - 2. Bed webs in mortar in starting course on footings and where adjacent to cells or cavities to be filled with grout.
 - 3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.
 - 4. Maintain joint widths indicated, except for minor variations required to maintain bond alignment. If not indicated, lay walls with 3/8 inch joints.

- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

3.06 HORIZONTAL JOINT REINFORCEMENT

- A. General: Provide continuous horizontal joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcing a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.
 - 2. Provide reinforcement in mortar joint 1 block course above and below wall openings and extending 12 inches beyond opening.
 - a. Reinforcement above is in addition to continuous reinforcement.
- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column pipe enclosures, and other special conditions.

3.07 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joints in unit masonry construction where indicated. Build-in related items as the masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.
- B. Form control joints in concrete masonry as follows:
 - 1. Install preformed control joint gaskets designed to fit standard sash block.
 - 2. Distance between control joint spacing shall not exceed the lesser of the following:
 - a. Length-to-height ratio of 1.5.
 - b. 25 feet.

- C. Build-in horizontal pressure-relieving joints where indicated; construct joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07920 "Joint Sealants."

3.08 LINTELS

- A. Provide masonry lintels where shown and where opening of more than 24 inches for block size units are shown without structural steel or other supporting lintels.
 - 1. Provide prefabricated or built-in masonry lintels. Use specially formed bond beam units with reinforcement bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installation. Temporarily support formed-in-place lintels until cured.
- B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.10 INSTALLATION OF REINFORCED UNIT MASONRY

- A. Temporary Formwork: Construct formwork and shores to support reinforced masonry elements during construction.
 - 1. Construct formwork to conform to shape, line, and dimensions shown. Make sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Protect concrete floor slabs from grout staining with polyethylene sheeting.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
 - 1. Do not exceed the following pour heights for fine grout:
 - a. For minimum widths of grout spaces of 3/4 inch or for minimum grout space of hollow unit cells of 1-1/2 by 2 inches, pour height of 12 inches.
 - b. For minimum widths of grout spaces of 2 inches or for minimum grout space of hollow unit cells of 2 by 3 inches, pour height of 60 inches.

- c. For minimum widths of grout spaces of 2-1/2 inches or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches, pour height of 12 feet.
 - d. For minimum widths of grout spaces of 3 inches or for minimum grout space of hollow unit cells of 3 by 3 inches, pour height of 24 feet.
- 2. Do not exceed the following pour heights for coarse grout:
 - a. For minimum widths of grout spaces of 1-1/2 inches or for minimum grout space of hollow unit cells of 1-1/2 by 3 inches, pour height of 12 inches.
 - b. For minimum widths of grout spaces of 2 inches or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches, pour height of 60 inches.
 - c. For minimum widths of grout spaces of 2-1/2 inches or for minimum grout space of hollow unit cells of 3 by 3-1/2 inches, pour height of 12 feet.
 - d. For minimum widths of grout spaces of 3 inches or for minimum grout space of hollow unit cells of 3 by 4 inches, pour height of 24 feet.
- 3. Provide cleanout holes at least 3 inches in least dimension for grout pours over 60 inches in height.
 - a. Provide cleanout holes at each vertical reinforcing bar.
 - b. At solid grouted masonry, provide cleanout holes at not more than 32 inches o.c.

3.11 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged, or if units do not match adjoining units. Install new units to match adjoining units; install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point-up all joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for application of sealants.
- B. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears prior to tooling joints.
- C. Protect slab from mortar spills and staining during construction.

- D. Final Cleaning: After mortar is thoroughly set and cured, clean masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
- E. Protection: Provide final protection and maintain conditions that ensure unit masonry is without damage and deterioration at time of Substantial Completion.
- F. Thoroughly clean all unfinished masonry.

END OF SECTION 04810

SECTION 05120
STRUCTURAL STEEL

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes structural steel.
- B. Related Sections include the following:
 - 1. Section 053100 "Steel Deck."
 - 2. Section 052100 "Steel Joist."

1.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Engineer structural steel connections required by the Contract Documents to be selected or completed by the fabricator to withstand design loadings indicated.
- B. Engineering Responsibility: Engage a fabricator who utilizes a qualified professional engineer to prepare calculations, shop drawings, and other structural data for structural steel connections.

1.03 SUBMITTALS

- A. Product for each type of product specified.
- B. Shop drawings detailing fabrication of structural steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - 3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.
 - 4. Submit structural steel shop drawings, including structural analysis data, signed and sealed by a professional engineer registered in the State of North Carolina.
- C. Qualification data for firms and persons specified in the "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.

- D. Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.
 - 1. Structural steel, including chemical and physical properties.
 - 2. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
 - 3. Shop primers.
 - 4. Nonshrink grout.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an AISC certified firm, with a minimum designation of CSE, who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Fabricator Qualifications: Engage an AISC certified firm, with a minimum designation of STD, experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.
- C. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC's "Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design."
 - 2. Research Council on Structural Connections" (RCSC) "Specification for Structural Joints Using High Strength Bolts."
- D. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code - Steel."
 - 1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver structural steel to Project in such quantities and at such times to ensure continuity of installation.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
 - 1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.

2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.
 3. Do not store materials on exposed dirt/soil.
 4. All materials stored on the slab shall be on wood pallets.
- C. Touch up all rusted areas.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Structural Steel Shapes, Plates, and Bars: As follows:
1. W-Shapes: As per drawings.
 2. Channels and Angles: As per drawings..
 3. Plate and Bar: As per drawings..
 4. Finish: Grey, except where indicated to be galvanized.
- B. Hot-Formed Steel Tubing: As per drawings.
- C. Anchor Bolts: As per drawings.
- D. Unfinished Threaded Fasteners: As per drawings.
- E. High-Strength Bolts, Nuts, and Washers: As per drawings.
1. Finish: As per drawings.
- F. Welding Electrodes: Comply with AWS requirements.

2.02 PRIMER

- A. Primer: fast-curing, lead- and chromate-free, universal modified-alkyd primer with good resistance to normal atmospheric corrosion, complying with performance requirements of FS TT-P-664, unless otherwise indicated on Drawings.

Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds and repair painting galvanized steel, with dry film containing not less than 93 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.

2.03 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland

cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)", of consistency suitable for application, and a 30-minute working time. Minimum 6000 psi compressive strength. Provide one of the following products:

1. "Euco N-S Grout;" Euclid Chemical Co.
2. "Vibropruf #11;" Lambert Corp.
3. "Crystex;" L & M Construction Chemicals, Inc.
4. "Masterflow 928 and 713;" Master Builders Technologies, Inc.
5. "SonogROUT 14;" Sonneborn Building Product - ChemRex, Inc.

2.04 FABRICATION

- A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in shop drawings.
 1. Camber structural steel members where indicated with natural camber up.
 2. Identify high-strength structural steel according to ASTM A 6, "Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling" and maintain markings until steel has been erected.
 3. Mark and match-mark materials for field assembly.
 4. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
 5. Complete structural steel assemblies, including welding of units, before starting shop priming operations.
 6. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.
- B. Framing connections to be double shear type, unless otherwise indicated on Drawings. Design connections for 55 percent of total load capacity derived from the uniform load constants table, Part 2 of the AISC Code.
- C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 1. Plane thermally cut edges to be welded.
- D. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.
- E. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, and only as shown on Drawings and approved shop drawings.
 1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.

2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.
- F. Openings, copes, and other steel cutting to have a 1/2 inch minimum radius.

2.05 SHOP CONNECTIONS

- A. Shop install and tighten non-high-strength bolts, except where high-strength bolts are indicated.
- B. Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using High Strength Bolts."
 1. Bolts: Grade A 325 high-strength bolts, unless otherwise indicated.
 2. Connection Type: Snug tightened.
- C. Weld Connections: Comply with AWS D1.1, "Structural Welding Code - Steel", for procedures, appearance and quality of welds, and methods used in correcting welding work.
 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.

2.06 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:
 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 2. Surfaces to be field welded.
 3. Surfaces to be high-strength bolted with slip-critical connections
 4. Galvanized surfaces
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Clean steel according to SSPC specifications as follows:
 1. SSPC-SP3 "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions and at a rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 2. Apply 2 coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.
- B. Verify the location and size of all floor and roof openings with other trades.
- C. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

3.03 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.
- B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior setting base bearing plates. Clean bottom surface of base and bearing plates.
 - 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
 - 3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
 - a. Comply with manufacturer's instructions for proprietary grout

materials.

- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
- E. Splice members only where indicated on approved shop drawings.
- F. Do not use thermal cutting during erection.
- G. Do not enlarge any holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

3.04 FIELD CONNECTIONS

- A. Install and tighten non high-strength bolts, except; where high-strength bolts are indicated.
- B. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints for High Strength Bolts."
 - 1. Bolts: Grade A 325 high-strength bolts, unless otherwise indicated.
 - 2. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.
- C. Weld Connections: Comply with AWS D1.1, "Structural Welding Code - Steel", for procedures, appearance and quality of welds, and methods used in correcting welding work.
 - 1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 - 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
 - 3. Welds not designed shall be fillet welds equal to 1/16 inch less than the least thick member. All welds cleaned and painted.

3.05 FIELD QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports.
 - 1. Testing agency will conduct and interpret tests and state in each report whether work complies with or deviates from requirements.
- B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate to not comply with specified requirements.
- C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- D. Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints for High Strength Bolts."
- E. Visually inspect all field welding. In addition to visual inspections, tested 50 percent of full penetration welds according to AWS D1.1, "Structural Welding Code - Steel".

3.06 CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
 - 1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils.
 - 2. Sand as needed for smooth finish.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A 780, "Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings".

END OF SECTION 05120

SECTION 05160

SHEAR-RATED METAL FRAMING SHEATHING

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the extent of gypsum panel/sheathing laminated to steel sheets with engineered fasteners and attachment spacing for interior and/or exterior use as required for shear strength.
- B. Related Sections include the following:
 - 1. Section 05400 "Cold Formed Metal Framing"
 - 2. Section 07543 "TPO Roofing"
 - 3. Section 09255 "Gypsum Board Assemblies"
 - 4. Section 09900 "Painting"

1.02 PERFORMANCE REQUIREMENTS

- A. Sure-board 200 Shear Wall Shear Capacity:
 - 1. The gage for framing and attachment of the Sure-Board Shear panel is designed by the EOR (engineer of record) to provide a panel shear capacity in accordance with IAPMO-ES evaluation report number ER-0126.
 - 2. No other similar materials, stated load capacities or methods of attachment to framing studs/track/plates other than those stated on these approvals for Sure-Board® products will be acceptable as an equal.

1.03 SUBMITTALS

- A. Shop drawings:
 - 1. Shear wall layout, framing and supports, with dimensions and sections.
 - 2. Shear wall / Diaphragm load tables using Sure-Board Series 200/200W/200S panels, fastener size/type and spacing will be attached to designed shear walls that define the size of required collector posts for shear, along with required wall framing hardware, size or gage and on center stud/joist spacing for Vertical/Diaphragm and Concentrated loads as well as lateral load resistance that have been engineered.
 - 3. Details of proprietary or non-proprietary components if included.

1.04 QUALITY ASSURANCE

- A. Sure-Board Shear Panel Quality Assurance Manual

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Sure-Board panel:
 - 1. All Sure-Board panels shall be packaged and handled to prevent damage during shipping and unloading.
 - 2. Cover Sure-Board® panels with waterproof material and ventilate to avoid condensation before installation.
 - 3. Store Sure-Board® off ground with one end elevated for moisture drainage.
 - 4. Do not bend sheet steel or break/mar gypsum board sheet while handling. If damage to panel should occur, repair of panel may be approved by manufacturer.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide sure-board shear panel/sheathing as manufactured by Sure-board.

2.02 MATERIALS

- A. Galvanized Steel:
 - 1. No.22 gage 0.027 inch (0.686mm) base-metal thickness minimum per ASTM A 653 CSGrade 33/hot dipped galvanized G40 minimum per ASTM A 924.
- B. Wallboard/Fiber Cement Sheathing Compliance:
 - 1. Wallboard complies with ASTM C 1325, C 1369, C 1177, C 1278, C 1288, C 1185 and C 1186 including MgO/Fiber Cement Sheathing.
- C. Fasteners:
 - 1. The fasteners used to fasten the Sure-Board® Series 200/200S Structural Panels to the steel framing are self-drilling/self-tapping pilot point flat head screws, #8 minimum diameter 0.138-inch (3.5 mm), with a minimum 0.3145-inch (8.0 mm) head diameter, 1.5-inch (31.7 mm) long, and a 3/8-inch minimum drill tip, complying with SAE J78, ASTM C 1513 and ASTM C 954. ESR-1271 by John Grabber & Assoc. or equal. (Refer to Sure-Board Recommended Tool List on Website for Recommended Screw Manufacturers and Part Numbers.) Series 200S should use #8 X 1-5/8" lg. Winged Driller Grabber Super Drive LOX drive screws or equal. See ICC-

ES Report ESR-1271. Series 200W Structural Panels when fastened to steel framing are attached with #10 X 3/4" minimum self-drilling/self-tapping pan-head screws. For wood framing the Sure-Board Series 200 Structural Panels are fastened with #8 X 2" minimum wood screws. Sure-Board Series 200W Structural Panels when attached to wood framing are fastened with 10d 1 1/4" minimum smooth plywood nails.

- D. Adhesives:
- E. The non-structural adhesive used to attach the steel to the gypsum wallboard or other non-structural sheathing shall be a water soluble, non-combustible type adhesive.
- F. Finished Sure-Board Sheet Steel Panels:
- G. The sheet steel is No. 22 gage /0.027 inch (0.686 mm) minimum base-metal thickness complying with ASTM A 653 CS, Grade 33, and is provided with a G40 minimum hot-dipped galvanized coating conforming to ASTM A 924. Available width of 48 inches (1219 mm) and lengths of 4feet through 12 feet (2438 through 3658 mm). Note: Special cut lengths are available upon request.
- H. Finished Sure-Board® Panels:
 - 1. Sure-Board® Series 200 Structural Panels: Each panel consist of 1/2, 5/8 or 3/4 inch (12.7, 15.9 or 19.1 mm) thick square or tapered-edge Type X or Type C Fire Rated gypsum wallboard or water resistant core sheathing complying with ASTM C 1369, fiber reinforced cement board complying with ASTM C 1325 as well as glass mat gypsum substrate complying with ASTM C 1177 and fiber reinforced gypsum panels complying with ASTM C 1278, laminated with water soluble adhesive to steel sheet. The steel sheet is No. 22 gage /0.027 inch (0.686 mm) minimum base-metal thickness, complying with ASTM A 653 CS, Grade 33, and is provided with G40 minimum hot-dipped galvanized coating conforming with ASTM A 924. Available width of 48 inches (1219 mm) and standard lengths of 8 through 12 feet (2438 through 3658 mm).

PART 3 - EXECUTION

3.01 INSTALLATION, FASTENERS, CUTTING, REPAIRING SURE-BOARD

- A. Condition of Material Pre-Installation Sure-Board® Series 200
 - 1. Always install Sure-Board® Series 200 when conditions and material are dry. If the Sure-Board® Series 200 panels are not covered or stored in a dry location, and should get wet due to inclement weather conditions, allow them to air dry before installing. We suggest, as with all gypsum products, you keep materials dry at all times, before

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installation. All gypsum panels are different in their physical composition and are manufactured for specific uses. Follow all appropriate manufacturers recommendations for storage, handling and installation of your Sure-Board®. The steel sheet is always attached against the framing studs to accomplish resistance capacities stated in Manufacturers tables for lateral force resistance.

- B. Fasteners and Application for installing Sure-Board® Series 200
1. Install fasteners using standard electric gypsum screw guns or collated screw guns.
 2. Install the screws into the studs at the approved spacing as indicated on the drawings. The Series 200 screws must have a longer drill tip (minimum 3/8" long), to avoid the "jacking" of the sheet steel from the stud and track during installation. A list of many other important tools and fasteners that are suggested for use with Sure-Board are available at www.sureboard.com and at www.sureboardtools.com. The depth of the head of the bugle head screws into the gypsum that occurs during the installation of the fasteners is adjustable on all standard gypsum screw guns. Fastener heads to be installed flush to the panel face material or just below the surface at the field and perimeter edges, and a minimum of 3/8" setback from all edges of the panel. Screws are to be within 1/4" from the edge of the panel to avoid compromising the structural integrity. Screws may be added where necessary if some of the fasteners are over-screwed below the surface of the panel or even have some fasteners installed closer than the recommended 3/8" to center of fastener from the perimeter edge, without compromising the structural integrity of the panel. Note: If unintentional over-screwing occurs in excess as defined by EOR, additional screws between the existing screws may be added, with no adverse affect to the structural performance of the Sure-Board panel.
 3. For installation of Sure-Board Series 200 in the Perpendicular or Horizontal Orientation to the framing you must include either blocking or a minimum 1 1/2 inch wide flat strapping that is the same gage as the framing materials field studs and track or field studs if heavier track material is used, at all horizontal or vertical joints of all panels. Note: When Panels are installed either in the Vertical or Horizontal Orientation to the framing studs, there is No Structural Requirement that the "Butt End" joints of the Sure-Board® Panels Must be Staggered in each Adjoining row to maintain Stated Structural Capacities in our Evaluation Report. The Straight Line Installed Joint of these stacked Panels will allow for a much more efficient framing and finishing process. With Sure-Board®, it is preferable for the Sure-Board® sheet steel to be installed flush to the stud surface whenever possible to allow for an even and undisturbed finish to the wall. Installing the straps over the Sure-Board Series 200 steel panels may be accomplished by first hanging and fastening the Sure-

Board Series 200 panels to the studs. After installation is complete, through the use of a drywall knife or router, score the drywall and remove the screws in the Sure-Board panels as necessary to allow for the removal of the unwanted gypsum where the strap is to be installed. Attach the strap over the Sure-Board® sheet steel and re-attach the sheet steel of the Sure-Board panel into new holes with the appropriate self tapping pan head fasteners into the provided studs or backing through the Sure-Board sheet steel. Now the Sure-Board panel is ready for inspection. This method allows the Sure-Board Series 200 panel to be attached flush and the strap to be recessed into the gypsum panel and attached directly to the stud flange surface with no visual effect to the finish. After the inspection, the gypsum patch is easily installed and finished. (Note: The gypsum sheet is not a structural component, once the Sure-Board Series 200 panel has been installed.)

4. Installation of the Series 200S sheathing is intended to have the extended steel tab projected toward the next row of sheathing and covered and used as a support member for the sheathing material between the floor joists and roof rafters to eliminate the need for additional blocking or backing. This method was demonstrated as very effective in testing when screwed into at each horizontal row and should be the standard installation procedure. All Sure-Board Series 200S sheathing shall be protected from damage from Construction equipment, heavy Scaffolding, Drywall Stocking Board Carts Etc. during Construction with an added temporary plywood sheathing in traffic areas until finish flooring materials are installed. If you have any installation or cutting questions, please contact us at the Sure-Board® Technical Support Hotline in California at our toll free number: (866) 469-7432 or email at: support@sureboard.com.

- C. Cutting Sure-Board® Series 200 is achieved very efficiently with the use of a ferrous metal cutting blade in a typical “sidewinder” type skilsaw. There are also several specifically designed metal cutting saws with a selection of metal cutting blades, described on our Sure-Board® Tools list, for cutting up to 3/8” thick steel plate. They significantly reduce the metal fragments exiting from the guard area with their revolutionary design, keeping in mind that all metal cutting tools require the use of eye and hand protection for the Safety of the operator. Refer to our website for our available list for recommended tools, blades and fasteners used today to make the installation of Sure-Board® efficient.

Series 200 Full length or width cutting:

1. Set blade depth to maximum 1/4” depth and cut steel only.
2. Cut steel sheet for required length or width with skilsaw.
3. Score gypsum with razor knife, bend over to score paper on face side.

4. Snap cut-off piece and clean up edge with rasp if necessary.
5. Hang Sure-Board® as you would regular gypsum and screw off.
6. Always wear Dust and Eye Protection when Cutting all Sure-Board® Products.

Series 200 Partial length or width, outlets and opening cuts:

7. Series 200 - Set blade depth to maximum 1/4" depth and cut steel only.
8. Series 200 only-Cut steel where necessary, minimal over cutting may be required to allow for routing gypsum at the corners.
9. Series 200 only-Peel off steel in required areas and hang Sure-Board Series 200 panel as you would a regular gypsum panel, and tack to studs.
10. Series 200 only-Use router to cut off unwanted gypsum at opening or outlet and complete the screwing of the Sure-Board® at the prescribed spacing.

D. Repairs on Field Damaged Gypsum on Sure-Board® Series 200

1. Where the gypsum panel is damaged during construction by field staff, weather conditions, etc. the repair of the damaged Sure-Board panels may be completed using the following method: 1.) Identify the damaged piece of gypsum. 2.) Score the gypsum panel with a drywall knife or router (set to depth of gypsum sheet). 3.) Remove existing bugle-head fasteners in the damaged portion and re-fasten the sheet steel at the prescribed spacing with a minimum #8 x 3/4" self tapping pan-head fasteners into new holes in the Sure-Board® sheet steel and the studs. 4.) After completing this operation, the Sure-Board® panel is secure. Reinstall gypsum board patch and screw off only as necessary to accommodate the taping process. The gypsum patch need only be screwed to the sheet steel of the Sure-Board to accommodate this process.

END OF SECTION 05160

SECTION 05210

STEEL JOISTS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. K-series and long-span steel joists.
 - 2. Joist girders.
 - 3. Joist accessories.

1.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads within limits and under conditions indicated.
- B. Design joists to withstand design loads with live load deflections no greater than the following:
 - 1. Floor Joists: Vertical deflection of 1/240 of the span.
 - 2. Roof Joists: Vertical deflection of 1/240 of the span.
- C. Design roof joists and bridging for the net uplift indicated on Drawings, and according to SJI "Specifications."

1.03 SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product specified.
- B. Shop Drawings: Show layout, mark, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, accessories, splice and connection details, and attachments to other units of Work. Provide signed and sealed shop drawings.
 - 1. Indicate locations and details of anchorage devices and bearing plates to be embedded in other construction.
- C. Welding certificates.
- D. Mill Certificates: Signed by bolt manufacturers certifying that bolts comply with requirements.
- E. Qualification Data: For manufacturer.

- F. All shop drawings shall be signed and sealed by a North Carolina licensed engineer.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Standard Specifications and Load Tables for Steel Joists and Joist Girders (referred to as "Specifications" in this Specification).
 - 1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.
- B. SJI Specifications: Comply with standard specifications in SJI's "Specifications" that are applicable to types of joists indicated.
- C. Welding: Qualify procedures and personnel according to AWS D1.1 "Structural Welding Code - Steel."
- D. Verify weight and location of all equipment or unique loads with Contractor prior to joist fabrication.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
- B. Protect joists from mud corrosion, deformation, and other damage during delivery, storage, and handling. Put on dunnage, on slab.

1.06 SEQUENCING

- A. Deliver steel bearing plates and other devices to be built into concrete construction.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Steel: Comply with SJI "Specifications" for web and steel-angle chord members.
- B. Steel Bearing Plates: ASTM A 36.
- C. High Strength Bolts and Nuts: ASTM A 325, Type 1, heavy hex steel

structural bolts; ASTM A 563 heavy hex carbon steel nuts; and ASTM F 436 hardened carbon steel washers.

1. Finish: Hot-dip zinc coating, ASTM A 153 , “Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware”, Class C.
- D. Welding Electrodes: Comply with AWS standards.
- E. Galvanizing Repair Paint: SSPC-Paint 20.

2.02 PRIMERS

- B. Primer: SSPC-Paint 15, Type I, gray oxide, complying with manufacturer’s standards and requirements of applicable SJI Specifications.

2.03 OPEN-WEB K-SERIES STEEL JOISTS

- A. Manufacture steel joists according to “Standard Specifications for Open Web Steel Joists, K-Series,” in SJI’s “Specifications,” with steel angle top- and bottom-chord members, underslung ends, and parallel top chord; of joist type indicated.
1. Joist Type: K-series steel joists.
- B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.
- C. Provide holes in chord members where shown for connecting and securing other construction to steel joists.
- D. Top-Chord Extensions: Extend top chords of joists with SJI’s Type S top-chord extensions where indicated, complying with SJI’s “Specifications.”
- E. Extended Ends: Extend bearing ends of joists with SJI’s Type R extended ends where indicated, complying with SJI’s “Specifications.”
- F. Do not camber joists, unless otherwise indicated on Drawings. For cambered joists, comply with SJI’s “Specifications.”

2.04 JOIST GIRDERS

- A. Manufacture joist girders according to “Standard Specifications for Joist Girders” in SJI’s “Specifications,” with steel-angle top- and bottom-chord members; with end and top-chord arrangements as indicated on Drawings.
- B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding

work.

- C. Provide holes in chord members for connecting and securing other construction to joist girders.
- D. Camber joist girders as indicated on Drawings.
- E. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.05 JOIST ACCESSORIES

- A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required.
- B. Fabricate steel bearing plates with integral anchorages of sizes and thicknesses indicated. Shop prime paint.
- C. Supply miscellaneous accessories, including splice plates and bolts required by the joist manufacturer to complete joist installation.

2.06 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories to be primed by hand-tool cleaning, SSPC-SP 2.
- B. Apply one shop coat of primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1.5 mil thick.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Do not install steel joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements of this Section.
 - 1. Before installation, splice joists delivered to Project site in more than one piece.
 - 2. Space, adjust, and align joists accurately in location before permanently fastening.
 - 3. Install temporary bracing and bridging, connections, and anchors to ensure joists are stabilized during construction.
 - 4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.
 - 5. Unless otherwise indicated, provide minimum bearing on supporting substrates as follows:
 - a. Masonry: 4 inches.
 - b. Steel: 2-1/2 inches.
- C. Field weld joists to supporting steel bearing plates. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- D. Bolt joists to supporting steel framework using high-strength structural bolts, unless otherwise indicated. Comply with the RCSC's "Allowable Stress Design Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.
- E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams. Bridging must align and be run plumb, square and true.

3.03 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing agency to inspect field welds and high-strength bolted connections and to perform field tests and inspections and prepare test and inspection reports.

- B. Field welds will be visually inspected according to AWS D1.1, "Structural Welding Code - Steel".
- C. Bolted connections will be visually inspected.
 - 1. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Allowable Stress Design Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."
 - 2. Field welds will be visually inspected.
- D. Correct deficiencies in Work that inspections and test reports have indicated are not in compliance with specified requirements.
- E. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.04 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780, "Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings", and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, and accessories.
 - 1. Clean and prepare surfaces by hand tool cleaning, SSPC-SP 2.
 - 2. Apply a compatible primer of the same type as the shop primer used on adjacent surfaces.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 05210

SECTION 053100

STEEL DECK

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Roof deck.

1.02 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product specified.
- B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, deck openings, special jointing, accessories, and attachments to other construction. Provide signed and sealed shop drawings.
- C. Product Certificates: Signed by steel deck manufacturers certifying that products furnished comply with requirements.
- D. Welder Certificates: Copies of certificates for welding procedures and personnel.
- E. Deck Priming Information.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced Installer who has completed steel deck 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.
- B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329, "Standard Specification for Agencies Engaged in Construction Inspection and/or Testing", to conduct the testing indicated, as documented according to ASTM E 548, "Standard Guide for General Criteria Used for Evaluating Laboratory Competence".

- C. Welding: Quality procedures and personnel according to AWS D1.1 “Structural Welding Code - Steel” and AWS D1.3 “Structural Welding Code - Sheet Steel.”
- D. AISI Specifications: Calculate structural characteristics of steel deck according to AISI’s “Specification for the Design of Cold-Formed Steel Structural Members.”
- E. Priming Quality Procedures.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Consolidated Systems, Inc.
 - 2. Epic Metals Corp.
 - 3. Marlyn Steel Products, Inc.
 - 4. Nucor Corp.; Vulcraft Div.
 - 5. Wheeling Corrugating Co.

2.02 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with “SDI Specifications and Commentary for Steel Roof Deck” in SDI Publication No. 30, and the following:
 - 1. Ungalvanized Steel Sheet: ASTM A 1008M, Designation SS, Grade 80/550.
 - 2. Primer: SSPC-Paint 15, Type I, complying with VOC limitations of authorities having jurisdiction.
 - a. Color: Underside White
 - 3. Deck Profile: Type B.
 - 4. Profile Depth: 1-1/2 inches.
 - 5. Design Uncoated Minimum Steel Thickness: As per Drawings

6. Span Condition: Three (3) span continuous.
7. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.03 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, powder-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359 inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- E. Steel Sheet Accessories: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 30 for overhang and slab depth.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punch hole of 3/8 inch minimum diameter. Provide for steel deck 0.0239 inch uncoated steel thickness and thinner.
- J. Sump Pans: As indicated on Drawings.
- K. Repair and Touch-Up Paint: Lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.02 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements of this Section.
- B. Locate decking bundles to prevent overloading of supporting members.
- C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting framing before being permanently fastened. Do not stretch or contract side-lap interlocks.
- D. Place deck panels flat and square and fasten to supporting framing without warp or deflection.
- E. Cut deck panels using saw only, torch cuts are not acceptable.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to the decking.
- G. Provide additional reinforcement at openings as required for strength, continuity of decking, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
- I. Locate mechanical fasteners and install according to deck manufacturer's written instructions. Decking at perimeter shall be welded to continuous angle.

3.03 ROOF DECK INSTALLATION

- A. Fasten roof deck panels to steel supporting members as indicated.

- B. Side Lap Fastening: Fasten side laps of panels between supports, at intervals as indicated on Drawings
- C. Perimeter Edge Fastening: Fasten perimeter edges of panels as indicated on Drawings
- D. End Bearing: Install deck ends over supporting framing with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum.
- E. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, reinforcing channels, and other accessories according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

3.04 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing agency to perform field quality control testing.
- B. Field welds will be subject to inspection.
- C. Pins will be subject to inspection.
- D. Testing agency will report test results promptly and in writing to Contractor, Architect and Owner.
- E. Remove and replace work that does not comply with specified requirements.
- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.05 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damage galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780, "Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings", and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation and apply repair paint.
- C. Touch-Up Paint: Welds, burn holes and smoke stains.
- D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.
- E. Repaint rusted deck.

END OF SECTION 05310

SECTION 05400

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes exterior and interior load-bearing wall framing and ceiling joist framing.
- B. Related Sections include the following:
 - 1. Section 05160 "Shear-Rated Metal Framing Sheathing"

1.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated.
 - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Interior and Exterior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height.
 - b. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.
 - 3. Design framing systems to provide for movement of framing members without damage or overstressing, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 - 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 1 inch.
- B. Cold-Formed Steel framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

1.03 SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage

details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, accessories, connection details, and attachments to adjoining Work.

1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welder certificates.
 - D. Qualification Data: For professional engineer.
 - E. All shop drawings shall be signed and sealed by a North Carolina licensed engineer.

1.04 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of shop drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of North Carolina and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Welding: Qualify procedures and personnel according to AWS D1.1 "Structural Welding Code--Steel" and AWS D1.3, "Structural Welding Code--Sheet Steel."
- D. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing of one of the following:
 - 1. Dale/Incor.
 - 2. Dietrich Metal Framing; a Worthington Industries Company.
 - 3. MarinoWare; Div. Of Ware Industries, Inc.
 - 4. Super Stud Building Products, Inc.
 - 5. United Metal Products, Inc.

2.02 MATERIALS

- A. Steel Sheet: ASTM A 1003, "Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members", Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - 1. Grade:
 - a. ST33H for 0.0428 inch and thinner steel sheet.
 - b. ST50H for 0.0538 inch and thickness steel sheet.
 - 2. Coating: G60.
 - 3. Steel studs shall be a minimum of 20 ga. (25 ga. not allowed)

2.03 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As indicated on Drawings.
 - 2. Flange Width: As indicated on Drawings.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
 - 1. Minimum Uncoated Steel Thickness: Matching steel studs.
 - 2. Flange Width: 1-1/4 inches, minimum.

2.04 CEILING JOIST FRAMING

- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As indicated on Drawings.
 - 2. Flange Width: As indicated on Drawings.

2.05 FRAMING ACCESSORIES

- A. Fabricate steel framing accessories from steel sheet, ASTM A 1003, "Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members", Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.

2.06 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36, zinc coated by the hot-dip process according to ASTM A 123, "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products".
- B. Anchor Bolts and Studs: ASTM F 1554, "Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength", Grade 36, threaded carbon steel bolts and flat, hardened-steel washers; zinc-coated by hot-dip process according to ASTM A 153, "Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware", Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times the design load, as determined by testing per ASTM E 488, "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements", conducted by a qualified independent testing agency.
- D. Powder-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times the design load, as determined by testing per ASTM E 1190, "Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members", conducted by a qualified independent testing agency.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws. Unless otherwise noted screws shall be #10 minimum and have a minimum tension value of 98 lbs. and a shear value of 263 lbs. in 0.043" (43 mil) material.
- F. Welding Electrodes: Comply with AWS standards.

2.07 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780, "Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings",
- B. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- C. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.08 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3, "Structural Welding Code--Sheet Steel", requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to shop drawings, with screw penetrating joined members by not less than 3 exposed screw threads.
 - 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to manufacturer's recommendations.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location.
 - 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3, "Structural Welding Code--Sheet Steel", requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to shop drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths. Splice connections are not permissible.

- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- I. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location.

3.03 LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
 - 1. Anchor Spacing: To match stud spacing.
- B. Squarely seat studs against webs of top and bottom tracks with gap not exceeding 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
 - 1. Stud Spacing: As indicated.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, to supporting structure as indicated.

- G. Install supplementary framing, blocking, and bracing in stud framing indicated to support work requiring attachment to framing.
 - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- H. Install horizontal bridging in stud system, type and spacing as indicated. Fasten at each stud intersection.
- I. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall framing system.

3.04 CEILING JOIST INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on the Shop Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track as indicated on the Shop Drawings.
- C. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.
- D. Install bridging at intervals indicated on Shop Drawings.
- E. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange as indicated on the Shop Drawings.
- F. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.05 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanizing repair paint according to ASTM A 780, "Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings", and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05400

SECTION 05500
METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following metal fabrications:
 - 1. Miscellaneous framing and supports.
 - 2. Miscellaneous steel trim, including the following:
 - a. Galvanized loading dock edge angles.
 - b. Bent plate guards at downspouts.
 - c. Bent plate guards at sectional overhead doors.
 - 3. Pipe bollards.
- B. Contractor shall note that separate Contract Documents, including Drawings and Specifications, have been prepared for, and are intended to cover, work associated with the Retail Build-Out portion of the Project.
- C. Related Sections:
 - 1. Section 05120 "Structural Steel."
 - 2. Section 05210 "Steel Joists."
 - 3. Section 05310 "Steel Deck."
 - 4. Section 08361 "Sectional Overhead Doors."
 - 5. Section 09900 "Painting."

1.02 REFERENCES

- A. American Welding Society (AWS):
 - 1. AWS D1.1: Structural Welding Code - Steel.
- B. ASME International (ASME):
 - 1. ASME B18.2.1: Square and Hex Bolts and Screws Inch Series.
 - 2. ASME B18.6.1: Wood Screws (Inch Series).
 - 3. ASME B18.6.3: Machine Screws and Machine Screw Nuts.
 - 4. ASME B18.21.1: Lock Washers (Inch Series).
 - 5. ASME B18.22.1: Plain Washers.

- C. ASTM International (ASTM):
1. ASTM A 36: Specification for Carbon Structural Steel.
 2. ASTM A 53: Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 3. ASTM A 123: Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 4. ASTM A 153: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 5. ASTM A 307: Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 6. ASTM A 563: Specification for Carbon and Alloy Steel Nuts.
 7. ASTM A 780: Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 8. ASTM B 633: Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
 9. ASTM C 1107: Specification for Packaged, Dry, Hydraulic-Cement Grout (Nonshrink).
 10. ASTM D 1187: Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
 11. ASTM E 488: Test Methods for Strength of Anchors in Concrete and Masonry Elements.
 12. ASTM F 593: Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 13. ASTM F 594: Specification for Stainless Steel Nuts.
 14. ASTM F 1941: Specification for Electrodeposited Coatings on Threaded Fasteners [Unified Inch Screw Threads (UN/UNR)].
- D. Master Painters Institute (MPI):
1. MPI #79: Alkyd Anti-Corrosive Metal Primer.
- E. SSPC: The Society for Protective Coatings:
1. SSPC-PA 1: Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel.
 2. SSPC-Paint 20: Paint Specification No. 20: Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").
 3. SSPC-SP 3: Surface Preparation Specification No. 3: Power Tool Cleaning.
 4. SSPC-SP 6/NACE No. 3: Joint Surface Preparation Standard SSPC SP 6/NACE No. 3: Commercial Blast Cleaning.

1.03 SUBMITTALS

- A. Product Data: For paint products and grout.
- B. Shop Drawings: Detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.
- C. Welding certificates.

1.04 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the Work.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1.

1.05 PROJECT CONDITIONS

- A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurement before fabrication; show recorded measurements on approved shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

1.06 COORDINATION

- A. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. 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.

PART 2 - PRODUCTS

2.01 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.02 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36.
- B. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless otherwise indicated, or another weight required by structural loads.
 - 1. Galvanized finish for exterior installation, shop primed.

2.03 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 25, at exterior walls. Select fasteners for the type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon head bolts, ASTM A 307, Grade A, with hex nuts, ASTM A 563, and where indicated, flat washers.
- C. Machine Screws: ASME B18.6.3.
- D. Lag Screws: ASME B18.2.1.
- E. Wood Screws: Flat head, ASME B18.6.1.
- F. Plain Washers: Round, ASME B18.22.1.
- G. Lock Washers: Helical, spring type, ASME B18.21.1.
- H. Post-Installed Expansion Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to 4 times the load imposed when installed in concrete as determined by testing according to ASTM E 488 conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5.
 - 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 2 stainless steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.04 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Nonshrink Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107, specifically recommended by manufacturer for interior and exterior applications. Subject to compliance with requirements, provide one of the following products:
 - 1. "Euco N-S Grout"; Euclid Chemical Co.
 - 2. "Vibropruf #11"; Lambert Corp.
 - 3. "Crystex"; L & M Construction Chemicals, Inc.
 - 4. "Masterflow 928 and 713"; Master Builders Technologies, Inc.
 - 5. "Sonogrout 14"; BASF Building Systems.
- F. Concrete for Bollards: Comply with Section 03300 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.05 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. 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.
- C. Form exposed work with accurate angles and surfaces and straight edges.

- D. Weld corners and seams continuously to comply with the following:
 - 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 welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- E. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- F. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- G. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- H. Provide anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.06 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports for applications indicated or which are not a part of structural steel framework, as required to complete work.
- B. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates and steel bars of welded construction, using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Equip units with integrally welded anchors for casting into concrete. Furnish inserts if units must be installed after concrete is placed. Except as otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4 inch thick by 8 inches long.
- C. Galvanize and shop prime miscellaneous framing and supports in the following locations; use exterior galvanized metal primer specified in Section 09900 "Painting":

1. Exterior locations.

2.07 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars of profiles shown with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible.
- B. Provide cutouts, fittings, and anchorages; coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete construction, spaced not more than 6 inches from each end, 6 inches from corners, and 24 inches o.c., unless otherwise indicated.
- C. Galvanize miscellaneous steel trim in the following locations:
 1. Exterior locations.

2.08 PIPE BOLLARDS

- A. Fabricate pipe bollards from Schedule 40 steel pipe. Fill solid with concrete and crown top as indicated. Provide galvanized and shop primed pipe bollards only for exterior locations. Use exterior galvanized metals primer specified in Section 09900 "Painting."
- B. Interior Bollards: Fabricate bollards with 3/8 inch thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4 inch anchor bolts.

2.10 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.11 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153 for steel and iron hardware and with ASTM A 123 for other steel and iron products.
 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items not indicated to be galvanized unless they

are embedded in concrete, or unless otherwise indicated.

1. Shop prime with universal shop primer.
 2. Exterior Galvanized Steel Fabrications: Shop prime with exterior galvanized metals primer specified in Section 09900 "Painting."
- C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
1. Exterior Items: SSPC-SP 6/NACE No.3.
 2. Other Items: SSPC-SP 3.
- D. Shop Priming: Apply shop primer to comply with requirements of SSPC-PA 1 for shop painting.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
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 welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

3.02 INSTALLING PIPE BOLLARDS

- A. Exterior Bollards: Set bollards in concrete by forming or core-drilling holes not less than 3/4 inch greater than outside diameter of post, and to depth as indicated. Clean holes of all loose material, insert bollards, and fill annular space between bollard with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up

approximately 1/8 inch toward bollard.

- B. Interior Bollards: Anchor bollards to concrete slabs with expansion anchors. Provide four 3/4 inch bolts, length as indicated, at each bollard unless otherwise indicated.
- C. Fill bollards solidly with concrete, mounding top surface to shed water.

3.03 ADJUSTING AND CLEANING

- A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used in shop and to comply with SSPC-PA 1 requirements for touch-up of field painted surfaces.
 - 1. Apply by brush or spray to provide a 2.0 mil minimum dry film thickness.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

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SECTION 05511

METAL STAIRS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Preassembled rooftop crossover steel stairs
- B. Related Sections:
 - 1. Section 09900 "Painting" for field finishing of shop-primed metal stairs.

1.02 REFERENCES

- A. American Welding Society (AWS):
 - 1. AWS D1.1: Structural Welding Code - Steel.
 - 2. AWS D1.3: Structural Welding Code - Sheet Steel.
- B. ASTM International (ASTM):
 - 1. ASTM A 36: Specification for Carbon Structural Steel.
 - 2. ASTM A 47: Specification for Ferritic Malleable Iron Castings.
 - 3. ASTM A 48: Specification for Gray Iron Castings.
 - 4. ASTM A 307: Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 - 5. ASTM A 500: Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - 6. ASTM A 510: Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
 - 7. ASTM A 563: Specification for Carbon and Alloy Steel Nuts.
 - 8. ASTM A 1011: Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
 - 9. ASTM B 633: Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
 - 10. ASTM C 1107: Specification for Packaged, Dry, Hydraulic-Cement Grout (Nonshrink).
 - 11. ASTM D 1187: Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
 - 12. ASTM E 488: Test Methods for Strength of Anchors in Concrete and Masonry Elements
 - 13. ASTM F 1941: Specification for Electrodeposited Coatings on Threaded Fasteners [Unified Inch Screw Threads (UN/UNR)].

- C. Master Painters Institute (MPI):
 - 1. MPI #79: Alkyd Anti-Corrosive Metal Primer.
- D. SSPC: The Society for Protective Coatings:
 - 1. SSPC-PA 1: Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel.
 - 2. SSPC-SP 3: Surface Preparation Specification No. 3: Power Tool Cleaning.

1.03 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design preassembled rooftop crossover metal stairs, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance for Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
 - 1. Uniform Load: 100 lbf/sq. ft.
 - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads specified in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.
- C. Structural Performance of Railings: 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. Infills 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

1.04 SUBMITTALS

- A. Product Data: For metal stairs and accessory support products
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. 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, licensed in the State of North Carolina, responsible for their preparation.
- D. Qualification Data: For qualified professional engineer.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. NAAMM Stair Standard: Comply with “Recommended Voluntary Minimum Standards for Fixed Metal Stairs” in NAAMM AMP 510 “Metal Stairs Manual” for class of stair designated, unless more stringent requirements are indicated.
 - 1. Preassembled Stairs: Commercial class.

1.06 COORDINATION

- A. Coordinate installation of anchorages for preassembled rooftop crossover steel stairs. Furnish setting drawings, templates, and directions for installing anchorages. Deliver such items to Project site in time for installation.
- B. Stair provider to notify the General Contractor in writing of any modifications required to the roofing system to accommodate the installation of preassembled rooftop crossover steel stairs. Stairs shall be installed in a way so as not to damage rooftop TPO membrane and insulation. Do not fabricate stairs until the Owner approves a method of installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Lapeyre Stair – Rooftop Crossover Stair. Provide custom design as required to meet the Project conditions.

2.02 MATERIALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36.
- C. Steel Tubing: ASTM A 500 (cold formed).
- D. Cast Iron: Either gray iron, ASTM A 48, or malleable iron, ASTM A 47, unless otherwise indicated.
- E. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011, either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.

2.03 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head type, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

2.04 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.05 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding, unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless other indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 - 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 welding flux immediately.
 - 4. Weld exposed corners and seams continuously, unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type I welds: no evidence of a welded joint.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

2.06 STAIR RAILINGS

- A. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
 - 1. Rails and Posts: Sizes as indicated on Drawings.

- B. Welded Connections: Fabricate railings with 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. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type I welds: no evidence of a welded joint.
- C. Form changes in direction of railings as detailed.
- D. Close exposed ends of railing members with prefabricated end fittings.
- E. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
 - 1. Connect posts to stair framing by direct welding unless otherwise indicated.
 - 2. For nongalvanized railings, provide nongalvanized ferrous metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

2.07 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Preassembled rooftop crossover steel stairs to receive factory finishes to be selected by Owner.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Coordinate delivery and installation with the General Contractor prior to delivery to the site.
- B. Rooftop stairs to be installed in a way that will not damage rooftop membranes or insulation. Coordinate with the General Contractor to determine if modifications to rooftop conditions need to be made to ensure a flat and level surface for stair installation

3.02 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after installation, preassembled stair provider to touch-up paint any damaged shop finishes.
- B. General Contractor to adjust levelness of preassembled stair prior to use.

END OF SECTION 05511

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SECTION 05521
STEEL PIPE RAILINGS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe handrails and railing systems.
- B. Related Sections:
 - 1. Section 05500 "Metal Fabrications."
 - 2. Section 05511 "Metal Stairs."
 - 3. Section 09900 "Painting."

1.02 REFERENCES

- A. American Welding Society (AWS):
 - 1. AWS D1.1: Structural Welding Code - Steel.
- B. ASTM International (ASTM):
 - 1. ASTM A 47: Specification for Ferritic Malleable Iron Castings.
 - 2. ASTM A 48: Specification for Gray Iron Castings.
 - 3. ASTM A 53: Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 4. ASTM A 123: Specification for Zinc (Hot-Dip) on Iron and Steel Hardware.
 - 5. ASTM A 153: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 6. ASTM C 1107: Specification for Packaged, Dry, Hydraulic-Cement Grout (Nonshrink).
 - 7. ASTM D 1187: Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
 - 8. ASTM E 488: Test Methods for Strength of Anchors in Concrete and Masonry Elements.
 - 9. ASTM F 2329: Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.
- C. Master Painters Institute (MPI):
 - 1. MPI #25: Etching Cleaner.
 - 2. MPI#134: Waterborne Galvanized Primer.

- D. SSPC: The Society for Protective Coatings:
 - 1. SSPC-PA 1: Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel.

1.03 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 railing systems to withstand structural loads indicated, determine allowable design working stresses of materials based on the following:
 - 1. 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. Infills of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior steel railings by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
- E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.04 SUBMITTALS

- A. Product Data: For grout and paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.

- C. 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.
- D. Qualification Data: For qualified professional engineer.
- E. Welder certificates.

1.05 QUALITY ASSURANCE

- A. Welding Standards: Qualify procedures and personnel according to ASW D1.1.

1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with steel pipe railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 METALS, GENERAL

- A. Metal Surfaces, General: Provide metals with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of the same material and finish as supported rails, unless otherwise indicated.

2.02 STEEL AND IRON

- A. Pipe: ASTM A 53, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
- B. Cast Iron: Either gray iron, ASTM A 48, or malleable iron, ASTM A 47, unless otherwise indicated.

2.03 FASTENERS

- A. General: Provide the following:
 - 1. Hot-Dip Galvanized Railings: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153 or ASTM F 2329 for zinc coating.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components: Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

2.04 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- C. Shop Primer for Galvanized Steel: Water based galvanized metal primer complying with MPI#134 and suitable to receive finish coats specified in Section 09900 "Painting."
- D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications. Subject to compliance with requirements, provide one of the following:
 - 1. "Euco N-S Grout"; Euclid Chemical Co.
 - 2. "Vibropruf #11"; Lambert Corp.
 - 3. "Crystex"; L & M Construction Chemicals, Inc.
 - 4. "Masterflow 928 and 713"; Master Builders Technologies, Inc.
 - 5. "Sonogrout 14"; BASF Building Systems.

2.05 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.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. 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 welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoins surfaces.
- I. Form changes in directions as detailed.

2.06 STEEL AND IRON FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- B. Galvanized Finish: Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
 - 1. Comply with ASTM A 123 for hot-dip galvanized railings.
 - 2. Comply with ASTM A 153 for hot-dip galvanized hardware.
 - 3. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

4. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- D. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- E. Primer Application: Apply shop primer to prepared surfaces of railings. Comply with requirements in SSPC-PA 1 for shop painting.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Fit exposed connections accurately 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 from 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. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.02 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components by welding. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.03 ANCHORING POSTS

- A. Form or core-drill holes not less than 5 inches deep and 3/4 inch greater than outside diameter of post for installing posts in concrete. Clean holes of all loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions. Leave filled post hole exposed, finishing grout as a wash with 1/8 inch buildup, crown and slope away from post.

3.04 ATTACHING RAILINGS

- A. Attach handrails to wall with wall brackets and end fittings. Provide brackets with 1-1/2 inch clearance from inside face of handrail to finished wall surface. Locate brackets as indicated, or if not indicated, at spacing required to support structural loads.
 - 1. Use type of bracket with predrilled hole for exposed bolt anchorage.
 - 2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- B. Secure wall brackets and railing end fittings to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in epoxy anchors.

3.05 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0 mil dry film thickness. Smooth application required.

3.06 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.

END OF SECTION 05521

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SECTION 06105
MISCELLANEOUS CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Rooftop equipment bases and support curbs.
 - 2. Wood grounds, nailers, and blocking.
 - 3. Interior plywood applications.
- B. Provide fire-retardant-treated wood components for miscellaneous carpentry items indicated on Drawings and as required by North Carolina Building Code.
- C. Related Sections:
 - 1. Section 07543 "Thermoplastic Polyolefin (TPO) Roofing."

1.02 REFERENCES

- A. American Wood-Preservers' Association (AWPA):
 - 1. AWWA C2: Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes.
 - 2. AWWA C9: Plywood - Preservative Treatment by Pressure Processes.
 - 3. AWWA C20: Structural Lumber - Fire-Retardant Treatment by Pressure Process.
 - 4. AWWA C27: Plywood - Fire-Retardant Treatment by Pressure Process.
 - 5. AWWA M4: Care of Preservative-Treated Wood Products.
- B. APA - The Engineered Wood Association:
 - 1. APA Form No. E30V: Engineered Wood Construction Guide.
- C. ASME International (ASME):
 - 1. ASME B18.6.1: Wood Screws (Inch Series).

- D. ASTM International (ASTM):
 - 1. ASTM A 153: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 2. ASTM A 307: Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 - 3. ASTM A 563: Specification for Carbon and Alloy Steel Nuts.
 - 4. ASTM A 653: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 5. ASTM B 117: Practice for Operating Salt Spray (Fog) Apparatus.
 - 6. ASTM C 954: Specification for Steel Drill Screws for the Application of Gypsum Board Products or Metal Plaster Bases to Steel Studs from 0.033 in. to 0.112 inc. in Thickness.
 - 7. ASTM D 226: Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 - 8. ASTM E 84: Test Method for Surface-Burning Characteristics of Building Materials.
 - 9. ASTM F 1667: Specification for Driven Fasteners: Nails, Spikes, and Staples.
- E. ICC Evaluation Service, Inc. (ICC):
 - 1. NES NER-272: Pneumatic or Mechanically driven Staples, Nails, P-Nails and Allied Fasteners for Use in All Types of Building Construction.
- F. U.S. Department of Commerce, National Institute of Standards and Technology (DOC):
 - 1. DOC PS-1: U.S. Product Standard for Construction and Industrial Plywood.
 - 2. DOC PS-20: American Softwood Lumber Standard.

1.03 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preserved treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
 - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.

3. For fire-retardant-treated wood products, include certification by treating plant that treated materials comply with specified standard and other requirements as well as data relative to bending strength, stiffness, and fastener-holder capacities of treated materials.
 4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. Research/Evaluation Reports: For the following, showing compliance with North Carolina Building Code:
1. Preservative-treated plywood.
 2. Fire-retardant-treated plywood.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber. Provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.
1. For wood members pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.01 LUMBER, GENERAL

- A. Lumber Standards: Comply with DOC PS-20 and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
- B. Plywood Standard: DOC PS-1.
- C. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:
1. SPIB - Southern Pine Inspection Bureau.
- D. Grade Stamps: Provide lumber with each piece factory-marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
1. Plywood Panels: Factory mark panels to indicate compliance with applicable standard.

- E. Where nominal sizes are indicated, provide actual sizes required by DOC PS-20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sized for dry lumber.
 - 1. Provide dressed lumber, S4S, unless otherwise indicated.
 - 2. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2 inch nominal thickness or less, unless otherwise indicated.

2.02 WOOD PRESERVATIVE TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWWA C2 (lumber) and AWWA C9 (plywood).
- B. Preservative Chemical: Alkaline copper quaternary (ACQ). Provide one of the following:
 - 1. "NatureWood"; Osmose Wood Preserving, Inc.
 - 2. "Preserve"; Chemical Specialties, Inc.
- C. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Mark each treated item with the treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- E. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing and flashing.
 - 2. Wood blocking, furring, similar concealed members in contact with concrete.
 - 3. Exterior plywood sheathing.

2.03 FIRE-RETARDANT TREATED MATERIALS

- A. General: Where fire-retardant-treated wood is indicated, comply with applicable requirements of AWWA C20 (lumber) and AWWA C27 (plywood). Identify fire-retardant- treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, Inc.; or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Treatment Type: Interior Type A.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Chemical Specialties, Inc.
 - 2. Hickson Corp.
 - 3. Hoover Treated Wood Products, Inc.

2.04 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, nailers, blocking, furring, grounds, stripping, and similar members.
- B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
- C. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.
- D. Grade: For dimension lumber sizes, provide Standard grade lumber per SPIB.

2.05 WOOD-BASED STRUCTURAL-USE PANELS

- A. Structural-Use Panel Standards: Provide all-veneer plywood panels complying with DOC PS 1.
- B. Trademark: Factory-mark structural-use panels with APA trademark evidencing compliance with grade requirements.
 - 1. Span Ratings: Provide panels with span ratings required to meet "Code Plus" provisions of APA Form No. E30V.

2.06 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - 1. For wall sheathing, provide fasteners with a G-90 hot-dip zinc coating complying with ASTM A 153 or of Type 304 stainless steel.
 - 2. Provide stainless steel fasteners or zinc-coated fasteners complying with ASTM A 653, G185 coating designation, where fasteners contact ACQ pressured-treated lumber.
- B. Nails, Wire, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
 - 1. For wall sheathing panels, provide screws with organic-polymer or corrosion-protective coating having a salt-spray resistance of more

- than 800 hours according to ASTM B 117.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and where indicated, flat washers.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.
- C. Fit carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- D. Apply field treatment complying with AWWPA M4 to cut surfaces of preservative-treated lumber.
- E. Securely attach carpentry work as indicated, complying with the following:
1. NES NER-272 for power-driven fasteners.
 2. Fastening schedule for wood construction in North Carolina Building Code.
- F. Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood.
- G. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- H. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.02 WOOD GROUNDS, NAILERS, AND BLOCKING

- A. Install where shown and where required for screeding or attaching other work. Cut and shape to required size. Coordinate locations with other work.
- B. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.03 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30K for types of structural-use panels and applications indicated.
 - 1. Comply with "Code Plus" installation provisions in guide referenced in paragraph above.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Screw to cold-formed metal framing.
 - 2. Space panels 1/8 inch apart at edges and ends

END OF SECTION 06105

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SECTION 07260

UNDERSLAB VAPOR RETARDER

PART 1 - GENERAL

1.01 SUMMARY

- A. Vapor retarder installed under interior concrete concrete slabs.
- B. Related Sections:
 - 1. Section 03300 "Cast-in-Place Concrete."
 - 2. Section 03350 "Interior Concrete Floor Slabs."

1.02 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 302.1R: Guide for Concrete Floor and Slab Construction.
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM D 4397: Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
 - 2. ASTM E 96: Standard Test Methods for Water Vapor Transmission of Materials.
 - 3. ASTM E 1643: Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
 - 4. ASTM E 1745: Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

1.03 SUBMITTALS

- A. Product Data: Manufacturer's technical literature and installation instructions.
- B. Samples: 12 inch by 12 inch sample of vapor barrier sheet.
- C. Test Reports: Independent laboratory test results showing compliance with referenced standards.

PART 2 - PRODUCTS

2.01 VAPOR RETARDER

- A. Plastic Vapor Retarder: ASTM E 1745, Class C or polyethylene sheet, ASTM D 4397, not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.
- B. Product/Manufacturer: One of the following:
 - 1. "Stego Wrap 10-mil Vapor Retarder"; Stego Industries LLC.
 - 2. "Griffolyn T-65"; Reef Industries.
 - 3. "Moistop Ultra 10"; Fortifiber Industries.
- C. Performance Criteria:
 - 1. Water Vapor Transmission Rate: 0.04 Perms or lower, per ASTM E 96.
 - 2. Water Vapor Retarder: Meets or exceeds Class C, per ASTM E 1745.
 - 3. Thickness of Retarder (Plastic): Minimum 10 mils, per ACI 302.1R.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Verify subsoil is acceptable to receive vapor retarder.
- B. Do not proceed with vapor retarder installation until unsatisfactory conditions are corrected.

3.02 INSTALLATION

- A. General: Comply with manufacturer's published instructions and ASTM E 1643 for placement, protection, and repair of vapor retarders.
- B. Unroll vapor retarder with longest dimension parallel with direction of pour.
- C. Lap vapor retarder over footings and seal to foundation walls.
- D. Overlap joints 6 inches and seal with manufacturer's tape. Tape seams continuously.
 - 1. Adhesion areas free from dust, dirt, and moisture to allow maximum adhesion of tape.

- E. Seal all penetrations, including pipe, rebar, wire, and blockouts, according to manufacturer's published instructions.
- 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 retarder, overlapping damaged area 6 inches and taping all four sides with tape.
 - 1. Clean all adhesion areas of dust, dirt, and moisture prior to taping.

END OF SECTION 07260

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SECTION 07543

THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Mechanically fastened TPO membrane roofing system.
 - 2. Roof insulation.
- B. Related Sections:
 - 1. Section 06105 "Miscellaneous Carpentry" for wood nailers, cants, curbs, and blocking.
 - 2. Section 07620 "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
 - 3. Section 07920 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
 - 4. Division 15 Section for roof drains.

1.02 REFERENCES

- A. American Society of Civil Engineers/Structural Engineering Institute (ASCE):
 - 1. ASCE/SEI 7: Minimum Design Loads for Buildings and Other Structures.
- B. ASTM International (ASTM):
 - 1. ASTM C 1177: Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
 - 2. ASTM C 1289: Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - 3. ASTM D 1079: Terminology Relating to Roofing and Waterproofing.
 - 4. ASTM D 6878: Specification for Thermoplastic Polyolefin Based Sheet Roofing.
 - 5. ASTM E 108: Test Methods for Fire Tests of Roof Coverings.
- C. FM Approvals:
 - 1. FM Approvals 4470: Approval Standard Class 1 Roof Covers (with 1987 and 1992 Supplements).

1.03 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.

1.04 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacturer, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experiences.
- C. Code Compliance: Total installation for roofing system must comply with the requirements of the North Carolina Building Code.
- D. 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 ASCE 7.
 - 1. Uplift Pressures: Corner, perimeter, and field-of-roof uplift pressures (lbf/sq. ft.) according to North Carolina Building Code for geographical location of Project.

1.05 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
 - 1. Base flashings, cants, and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened membrane roofing.
 - 4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

- C. Samples for Verification: For the following products:
 - 1. Sheet roofing, of color specified, including T-shaped side and end lap seam.
 - 2. Roof insulation.
 - 3. Walkway pads or rolls.
 - 4. Metal termination bars.
 - 5. Battens.
 - 6. Six insulation fasteners of each type, length, and finish.
 - 7. Six roof cover fasteners of each type, length, and finish.
- D. Qualification Data: For qualified installer.
- E. Manufacturer Certificates: Signed by roofing system manufacturer certifying that the roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of meeting performance requirements.
- F. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, for components of roofing system.
- G. Field quality control reports from manufacturer. Submit individual reports to the Architect, Owner, and Contractor.
- H. Maintenance Data: For roofing system to include in maintenance manuals.
- I. Warranties: Sample of special warranties.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product; and that is eligible to receive manufacturer's warranty.
- B. Manufacturer's Field Representative: Manufacturer to provide an authorized field representative to be present at the preliminary roofing conference and on-site as follows, starting at the commencement of work:
 - 1. Four (4) progress inspections in the following order:
 - a. Start of installation.
 - b. 30 percent completion.
 - c. 60 percent completion.
 - d. 90 percent completion.

2. Two-Stage Final Inspection:
 - a. Initial final inspection in conjunction with development of the Contractor's corrective work punchlist.
 - b. Second final inspection to verify all corrective work has been performed and all eligibility requirements of the specified manufacturer's warranty have been satisfied.
- B. Source Limitations: Obtain components for membrane roofing system from same manufacturer as roofing membrane or approved by roofing membrane manufacturer.
- C. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
- D. Preliminary Roofing Conference: Before starting roof system construction, conduct conference at Project site.
 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's authorized field 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. Review 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 of 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.

1.07 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, approval or listing agency markings, and directions for storing and mixing with other components.
- 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.

1.08 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with roofing work only when existing and forecasted weather conditions permit roofing to be installed according to manufacturers' written instructions and warranty requirements.

1.09 WARRANTY

- A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation (No Dollar Limit), in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, roof accessories, and other components of roofing system.
 - 2. Warranty Period: 20 years from date of Certificate of Occupancy.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of roofing system such as membrane roofing, base flashing, roof insulation, fasteners, and walkway products, for the following warranty period:
 - 1. Warranty Period: Three years from date of Certificate of Occupancy.

PART 2 - PRODUCTS

2.01 TPO MEMBRANE ROOFING

- A. TPO Sheet: ASTM D 6878, internally fabric or scrim reinforced, uniform, flexible TPO sheet.
 - 1. Acceptable Products: One of the following:
 - a. Carlisle SynTec Incorporated; Sure-Weld TPO.
 - b. Firestone Building Products Company; Ultra Ply TPO.
 - c. Johns Manville; JM TPO6 ST6RM-S.
 - d. GAF Materials Corp.; EverGuard TPO
 - 2. Thickness: 60 mils, nominal.
 - 3. Exposed Face Color: White.

2.02 AUXILIARY MEMBRANE ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
- B. Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheet flashing, 55 mils thick, minimum, of same color as sheet membrane.
- C. Bonding Adhesive: Manufacturer's standard.
- D. Metal Termination Bars: Manufacturer's standard predrilled stainless steel or aluminum bars, approximately 1 inch wide by 1/8 inch thick; with anchors.
- E. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.
- F. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions of FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.03 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by TPO membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches, unless otherwise indicated.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.04 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
- B. Fasteners: Factory-coated steel fasteners and metal plates meeting corrosion-resistance provisions of FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

2.05 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick, matching color, and acceptable to membrane roofing system manufacturer.

PART 3 - EXECUTION

3.01 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.
 - 2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and match thicknesses of insulation.

3. Verify that surface plane flatness and fastening of steel roof deck comply with requirements in Section 05310 "Steel Deck."
 4. Verify that steel roof deck welds have been painted.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances.
- 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. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.03 INSULATION INSTALLATION

- A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. 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.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

- G. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - 1. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

3.04 MECHANICALLY FASTENED MEMBRANE ROOFING INSTALLATION

- A. Mechanically fasten membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.
- B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.
- C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Mechanically fasten or adhere membrane roofing securely at terminations, penetrations, and perimeter of roofing.
- E. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
- F. In-Seam Attachment: Secure one edge of TPO sheet using fastening plates or metal battens centered within membrane seam and mechanically fasten TPO sheet to roof deck.
- G. Seams: Clean seam areas, overlapping membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
 - 2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.

3.05 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrate according to membrane roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of flashing sheet at required rate and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings.

3.06 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.
- B. Provide two rows of walkways at each side of ladders, rooftop RTUs, and as indicated on Drawings.

3.07 FIELD QUALITY CONTROL

- A. Roof Inspections: Arrange for roofing system manufacturer's authorized field representative to inspect roofing installation at the four (4) progress stages and for final inspection on completion of the work as specified in Article 1.06 "Quality Assurance" of this Section.
- B. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.
- C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.08 PROTECTING AND CLEANING

- A. Protect membrane 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 membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane 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 required by manufacturer of affected construction.

3.09 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS <Insert name> of <Insert address>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 - 1. Owner: <Insert name of Owner>
 - 2. Address: <Insert address>
 - 3. Building Name/Type: <Insert information>
 - 4. Address: <Insert address>
 - 5. Area of Work: <Insert information>
 - 6. Acceptance Date: <Insert year>
 - 7. Warranty Period: <Insert year>
 - 8. Expiration Date: <Insert year>
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

- D. This Warranty is made subject to the following terms and conditions:
1. The Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
 2. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.
- E. IN WITNESS THEREOF, this instrument has been duly executed this **<Insert day>** day of **<Insert month>**, **<Insert year>**.
1. Authorized Signature: **<Insert signature>**
 2. Name: **<Insert name>**
 3. Title: **<Insert title>**

END OF SECTION 07543

SECTION 07620

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes sheet metal flashing and trim in the following categories:
 - 1. Prefinished copings.
 - 2. Prefinished gutters and downspouts.
 - 3. Prefinished exposed metal flashing and counterflashing.
 - 4. Reglets.
- B. Related Sections:
 - 1. Section 07543 "Thermoplastic Polyolefin (TPO) Roofing."
 - 2. Section 07920 "Joint Sealants."
 - 3. Section 09900 "Painting" for field finish painting.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM A 153: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 2. ASTM A 653: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 3. ASTM A 755: Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
 - 4. ASTM B 32: Specification for Solder Metal.
 - 5. ASTM C 920: Specification for Elastomeric Joint Sealants.
 - 6. ASTM C 1311: Specification for Solvent Release Sealants.
 - 7. ASTM D 1187: Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
 - 8. ASTM D 4586: Specification for Asphalt Roof Cement, Asbestos-Free.
 - 9. ASTM F 2329: Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.

1.03 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Fabricate and install roof edge flashing capable of resisting wind forces required by the North Carolina Building Code for the geographical location of the Project.
- C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from ambient and surface temperature changes.
- D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
 - 1. Identification of material, thickness, weight, and finish for each item and location.
 - 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 - 3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including layout of fasteners, clips, cleats, and attachments. Include pattern of seams.
 - 4. Details of expansion joints and expansion joint covers, including showing direction of expansion and contraction.
 - 5. Details of edge conditions and counterflashings.
 - 6. Details of special conditions.
 - 7. Details of connections to adjoining work.
- C. Qualification Data: For qualified fabricator.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrication during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.07 PROJECT CONDITIONS

- A. Coordinate Work of this Section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance, durability of work, and protection of materials and finishes.

1.08 WARRANTY

- A. Special Project Warranty: Contractor and Installer warrant that Work of this Section shall be in compliance with Contract Documents and free from faults and defects in materials and workmanship.
 - 1. Warranty Period: 3 years from date of Certificate of Occupancy.
- B. Special Fluoropolymer Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.
 - 1. Warranty Period: 20 years from date of Certificate of Occupancy.

PART 2 - PRODUCTS

2.01 SHEET METALS

- A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.
 - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 coating designation; structural quality.
 - 2. Surface: Smooth, flat. Prefinished with two-coat fluoropolymer coating system complying with AAMA A2605. Color as indicated on Drawings.

2.02 MISCELLANEOUS MATERIALS

- A. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 - 1. General: Blind fasteners of self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
 - b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike and ferrule matching internal gutter width.
 - 2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153 or ASTM F 2329 or Series 300 stainless steel.
- B. Solder:
 - 1. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.01 REGLETS

- A. General: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces and compatible with flashing indicated with factory-mitered and –welded corners and junctions.
- B. Basis of Design: "Springlok Flashing System"; Fry Reglet Corporation.
Other acceptable manufacturers:
 - 1. W.P. Hickman Co.
 - 2. Keystone Flashing Company, Inc.
 - 3. Sandell Manufacturing Company, Inc.
- C. Material: Galvanized steel, 0.022 inch thick.
- D. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
- E. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of the counterflashing lower edge.
 - 1. Material: Galvanized steel, 0.022 inch thickness.

2.02 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Shop fabricate items to greatest extent possible.
 - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 2. Obtain field measurements for accurate fit before shop fabrication.
 - 3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 - 4. Conceal fasteners and expansion provisions where possible.
Exposed fasteners are not allowed on faces exposed to view.

- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8 inch offset of adjoining faces and of alignment of matching profiles.
- C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
- D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but never less than thickness of metal being secured.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

2.03 SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricated in minimum 10 foot long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion joint covers, and gutter accessories from same metal as gutters.
 - 1. Expansion Joints: Butt type.
 - 2. Metal Material and Thickness: 0.050 inch thick galvanized steel.
- B. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 1. Metal Thickness: 0.0276 inch.
- C. Copings: Fabricate in minimum 96 inch long, but not exceeding 10 foot long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg interior leg. Miter corners, seal, and solder or weld watertight.
 - 1. Joint Style: Butt, with 12 inch wide, concealed backup cover plates.

2. Fabricate from the following material:
 - a. Galvanized Steel: 0.040 inch thick.
- D. Roof to Roof Edge Flashing and Fascia Cap Transition Expansion Joint Cover. Fabricate from the following material:
 1. Galvanized Steel: 0.034 inch thick.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify locations, dimensions and other conditions affecting performance of the Work.
 1. Verify compliance with requirements for installation tolerances of substrates.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 3. Space cleats not more than 12 inches apart, unless continuous cleats indicated or required for Code compliance. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 5. Install sealant tape where indicated.
 6. Torch cutting of sheet metal flashing and trim is not permitted.

- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- D. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
 - 1. Galvanized Steel: Use stainless steel fasteners.
 - 2. Aluminum: Use aluminum or stainless steel fasteners.
- E. Seal joints as shown and as required for watertight construction.
 - 1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 07920 "Joint Sealants."
- F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches except reduce pre-tinning where pre-tinned surface would show in completed Work.
 - 1. Do not solder metallic-coated steel sheet.
 - 2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

3.03 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

- B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets and straps spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
 - 1. Fasten gutter spacers to front and back of gutter.
 - 2. Loosely lock straps to front gutter bead and anchor to roof deck.
 - 3. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion joint caps.
- C. Downspouts: Join sections with 1-1/2 inch telescoping joints.
 - 1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c. in between.
 - 2. Terminate downspouts at 3 inches above finished pavement or finished grade as indicated on Drawings.

3.04 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to North Carolina Building Code wind force uplift requirements for geographical location of Project and as indicated. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at maximum 16 inch centers.
- C. Copings: Anchor to resist uplift and outward forces according to North Carolina Building Code wind force uplift requirements for geographical location of Project and as indicated. Interlock bottom edge of coping with continuous cleats anchored to substrate at maximum 16 inch centers.
- D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.

3.05 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8 inch offset of adjoining faces and of alignment of matching profiles.

3.06 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07620

SECTION 07920
JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Joint sealants in locations as indicated on Drawings.
- B. Related Sections:
 - 1. Section 03255 "Interior Floor Joint Filler" for epoxy joint sealants in interior concrete slabs.
 - 2. Section 07543 "Thermoplastic Polyolefin (TPO) Roofing."
 - 3. Section 07620 "Sheet Metal Flashing and Trim."

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM C 834: Specification for Latex Sealants.
 - 2. ASTM C 920: Specification for Elastomeric Joint Sealants.
 - 3. ASTM C 1021: Practice for Laboratories Engaged in Testing of Building Sealants.
 - 4. ASTM C 1193: Guide for Use of Joint Sealants.
 - 5. ASTM C 1311: Specification for Solvent Release Sealants.
 - 6. ASTM C 1330: Specification for Cylindrical Sealant Backing for Use with Cold Applied Sealants.

1.03 SUBMITTALS

- A. Product Data: For each joint sealant product required.
- B. Samples for Verification: For each kind and color of joint sealant required, provide samples with joint sealants in 1/2 inch wide joints formed between two 6 inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- C. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- E. Warranty: Sample of specified warranty.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of sealants required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from a source from single manufacturer.
- C. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.06 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
 - 2. When joint substrates are wet.
- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.07 WARRANTY

- A. Special Project Warranty: Provide written warranty, signed by Contractor and Installer, that joint sealants will be free from faults and defects in materials and workmanship and that all defects occurring within this period shall be promptly corrected at no additional cost to Owner.
 - 1. Warranty Period: 2 years from date of Certificate of Occupancy.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants and other related materials that are compatible with one another and with joint substrates under conditions of service and application.
- B. Colors: Provide color of exposed joint sealants to comply with the following:
 - 1. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

2.02 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing elastomeric sealants that comply with ASTM C 920 and other requirements specified herein, including those requirements referencing ASTM C 920 classifications for Type, Grade, Class, and Uses.
- B. Base Polymer: Urethane.
 - 1. Type: M (multicomponent).
 - 2. Grade: P (pourable).
 - 3. Class: 25.
 - 4. Use Related to Exposure: T (traffic).
 - 5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.
 - 6. Multicomponent Pourable Products:
 - a. "Vulkem 245"; Tremco, Inc.
 - b. "NR-200 Urexpan"; Pecora Corp.
 - c. "Sikaflex - 2c SL"; Sika Corp.
 - d. "Sonolastic SL 2"; BASF Building Systems.

- C. Base Polymer: Urethane.
 - 1. Type: S (single component).
 - 2. Grade: NS (nonsag).
 - 3. Class: 25.
 - 4. Use Related to Exposure: NT (nontraffic).
 - 5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.
 - 6. Single Component Nonsag Products:
 - a. "Vulkem 116"; Tremco, Inc.
 - b. "Dynatrol I"; Pecora Corp.
 - c. "Sikaflex-1a"; Sika Corp.
 - d. "Sonolastic NP 1"; BASF Building Systems.

2.03 SOLVENT-RELEASE-CURING JOINT SEALANTS

- A. Acrylic-Based Joint Sealant: ASTM C 1311. Provide one of the following:
 - 1. "Acryl-R Acrylic Sealant"; Schnee-Morehead, Inc.
 - 2. "Mono 555"; Tremco, Inc.
- B. Butyl-Rubber-Based Joint Sealant: ASTM C 1311. Provide one of the following:
 - 1. "BC-158"; Pecora Corp.
 - 2. "Chem-Calk 300"; Bostik, Inc.
 - 3. "Tremco Butyl Sealant"; Tremco, Inc.

2.04 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
- B. Products: Subject to compliance with requirements, provided one of the following:
 - 1. "AC-20+"; Pecora Corp.
 - 2. "Sonolac"; BASF Building Systems.
 - 3. "Tremflex 834"; Tremco, Inc.

2.05 TAPE SEALANTS

- A. Tape Sealant: Manufacturer's standard, solvent-free, butyl-based tape sealant with a solids content of 100 percent formulated to be nonstaining, paintable, and nonmigrating in contact with nonporous surfaces with or without reinforcement thread to prevent stretch and packaged on rolls with a release paper on one side. Provide one of the following:
 - 1. "Extru-Seal Tape"; Pecora Corp.
 - 2. "Shim-Seal Tape"; Pecora Corp.
 - 3. "PTI 606"; H.B. Fuller.

4. "POLYshim II Tape"; Tremco, Inc.

2.06 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates and primers; and are approved for applications indicated by sealant manufacturer.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.07 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for; sealant adhesion; and compatibility by sealant manufacturer), old joint sealants, oil, grease, water, surface dirt, and frost.
 - 2. Clean concrete and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations; by vacuuming or blowing out joints with oil-free compressed air.
 - 3. Remove laitance and form release agents from concrete.
 - 4. Clean metal, glass, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's published installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

- C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
 - 1. Install backing materials of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of backing.
 - b. Do not stretch, twist, puncture, or tear backing.
 - c. Remove absorbent backing materials that have become wet prior to sealant application and replace with dry material.
 - 2. Install bond breaker tape between sealants where backer rods are not used between sealants and back of joints.
- D. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
- E. Tooling Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.04 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.
- B. Coordinate cleaning of exposed sealant surfaces with paint finish material requirements.

3.05 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that installations with repaired areas are indistinguishable from original work.

3.06 JOINT SEALANT SCHEDULE

- A. Seal all exterior concrete pavement joints abutting vertical surfaces with single part polyurethane sealant.
- B. Seal all concrete tilt wall panel joints and perimeter joints of exterior openings with single part polyurethane sealant.
- C. Seal all exterior concrete pavement joints with multipart pourable polyurethane sealant.
- D. Seal all interior exposed slab joints abutting vertical surfaces with acrylic-latex sealant.
- E. Other sealant applications, including interior exposed slab joints, as specified elsewhere.

END OF SECTION 07920

SECTION 08110
STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes standard steel doors and frames.
- B. Related Sections:
 - 1. Section 08710 "Door Hardware."
 - 2. Section 09900 "Painting" for field painting primed doors and frames.

1.02 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI/DHI A115 Series: Specifications for Steel Door and Frame Preparation for Hardware.
 - 2. ANSI/SDI A250.4: Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings.
 - 3. ANSI/SDI A250.6: Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
 - 4. ANSI/SDI A250.8: Recommended Specifications for Standard Steel Doors and Frames.
 - 5. ANSI/SDI A250.11: Recommended Erection Instructions for Steel Frames.
- B. ASTM International (ASTM):
 - 1. ASTM A 153: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 2. ASTM A 591: Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Weight [Mass] Application.
 - 3. ASTM A 653: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 4. ASTM A 1008: Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 5. ASTM A 1011: Specification for Steel, Sheet and Strip, Hot Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

6. ASTM C 143: Test Method for Slump of Hydraulic Cement Concrete.
 7. ASTM C 476: Specification for Grout for Masonry.
- C. SSPC: The Society for Protective Coatings (SSPC):
1. SSPC-Paint 12: Paint Specification No. 12: Cold-Applied Asphalt Mastic (Extra Thick Film).
- D. Steel Door Institute (SDI):
1. SDI 111C: Recommended Louver Details for Standard Steel Doors.
 2. SDI 117: Manufacturing Tolerances for Standard Steel Doors and Frames.

1.03 SUBMITTALS

- A. Product Data: For each type of door and frame specified. Include construction details, material descriptions, dimensions, hardware preparation, core descriptions, label compliance, profiles, and finishes.
- B. Shop Drawings: Showing fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.
- C. Door Schedule: Submit schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings.

1.04 QUALITY ASSURANCE

- A. Source Limitation: Obtain steel doors and frames from single source from single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Inspect doors and frames on delivery for damage. Minor damages may be repaired provided refinished items match new work and are acceptable to Owner's Representative; otherwise, remove and replace damaged items as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4 inch high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If cardboard wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4 inch space between stacked doors to promote air circulation.

1.06 PERFORMANCE REQUIREMENTS

- A. Code Compliance: Total installation for exterior doors must comply with the requirements of the North Carolina Building Code.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Pioneer Industries. Subject to compliance with requirements, equivalent products by one of the following manufacturers are also acceptable:
 - 1. Ceco Door Products.
 - 2. Curries Co.
 - 3. Kewanee Corp.
 - 4. Republic Builders Products.
 - 5. Steelcraft.

2.02 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653, Commercial Steel (CS), Type B.

- D. Frame Anchors: ASTM A 591, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008 or ASTM A 1011, hot-dip galvanized according to ASTM A 153, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153.
- F. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143.
- G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15 mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.03 STEEL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicate; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
 - 1. Core Construction: Manufacturer's standard polystyrene core. Provide insulated doors as follows:
 - a. Thermal-Rated Doors: Provide doors fabricated with thermal resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
 - b. Applications: All exterior doors.
 - 2. Vertical Edges: Beveled edge; 1/8 inch in 2 inches.
 - 3. Top and Bottom Edges: Closed with flush or inverted 0.042 inch thick, end closures or channels of same material as face sheets.
 - 4. Tolerances: Comply with SDI 117.
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below, according to ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level.
 - 1. Basis of Design: "HP Series"; Pioneer Industries.
 - 2. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless). 1-3/4 inch door thickness. 0.053 inch thick face sheets.
 - 3. Galvannealed Steel Sheets: Zinc-iron alloy-coated steel sheets of commercial quality, complying with ASTM A653, A60 coating.

- C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. 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. Basis of Design: "HP Series"; Pioneer Industries.
 - 2. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless). 1-3/4 inch door thickness. 0.042 inch thick face sheets.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.04 STEEL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Basis of Design, Exterior and Interior Frames: "Series F-16"; Pioneer Industries.
- C. Exterior Frames: Fabricated from galvanized steel sheet.
 - 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames as full profile welded.
 - 3. Frames for Level 3 Steel Doors: 0.053 inch thick steel sheet.
 - 4. Galvanized Steel Sheets: Zinc-iron alloy-coated steel sheets of commercial quality, complying with ASTM A653, A60 coating.
- D. Interior Frames: Fabricated from cold-rolled steel sheet.
 - 1. Fabricate full profile welded frames. Knocked down frames are not permissible.
 - 2. Frames for Level 2 Steel Doors: 0.053 inch thick steel sheet.
- E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.05 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.

- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.06 ACCESSORIES

- A. Ceiling Struts: Minimum 1/4 inch thick by 1 inch wide steel.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.07 FABRICATION

- A. Fabricate steel door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.
- B. Tolerances: Comply with SDI 117.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- D. Hollow Metal Frames: 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.
 - 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 - 4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 - 5. 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 according to referenced standards and

approved shop drawings.

6. Door Silencers: Except on weatherstripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified Section 08710 "Door Hardware."
 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive nontemplated, 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.

2.10 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

PART 3 - EXECUTION

3.01 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. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

- C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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 Squareness, alignment, twist, and plumbness to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and secured 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.
 - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
 - a. Install door silencers in frames before grouting.
 - b. Remove temporary braces necessary for installation only after frames have been properly set and secured.

- c. Check plumbness, Squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - d. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
- 2. Floor Anchors: Provide floor anchors for each jamb that extends to floor, and secure with postinstalled expansion anchors.
- 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
- 4. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
- 5. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
- 6. Installation Tolerances: Adjust hollow metal door frames for Squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- 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 Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - Exception: Provide 1" undercuts were required in the construction documents for air make-up.
 - c. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch

3.04 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, concrete and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Refinish or replace doors damaged during installation or prior to Owner acceptance.
- F. Rehang or replace doors that do not swing or operate freely.

END OF SECTION 08110

SECTION 08361

SECTIONAL OVERHEAD DOORS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following types of sectional overhead doors:
 - 1. Doors with insulated steel-framed steel panels.
 - 2. Tracks configured for standard vertical lift.
- B. Related Sections:
 - 1. Section 08710 "Door Hardware" for lock cylinders and keying.
 - 2. Division 16 Sections for electrical service, connections, disconnect switches and circuit breakers for powered operators.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM A 36: Specification for Carbon Structural Steel.
 - 2. ASTM A 123: Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 3. ASTM A 229: Specification for Steel Wire, Oil-Tempered for Mechanical Springs.
 - 4. ASTM A 653: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 5. ASTM C 1036: Specification for Flat Glass.
- B. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA ICS 1: Industrial Control and Systems: General Requirements.
 - 2. NEMA ICS 2: Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts.
 - 3. NEMA ICS 6: Industrial Control and Systems: Enclosures.
 - 4. NEMA MG 1: Motors and Generators.
- C. National Fire Protection Association (NFPA):
 - 1. NFPA 70: National Electrical Code.

1.03 DEFINITIONS

- A. Operation Cycle: One complete cycle of a door begins with the door in the closed position. The door is then moved to the open position and back to the closed position.

1.04 PERFORMANCE REQUIREMENTS

- A. Code Compliance: Total installation for exterior doors must comply with the requirements of the North Carolina Building Code.
- B. Structural Performance: Provide sectional overhead doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
 - 1. Wind Load: Uniform pressure (velocity pressure), acting inward and outward, to comply with North Carolina Building Code requirements.
- C. Operation-Cycle Requirements: Design sectional overhead door components and operator to operate for not less than 25,000 cycles.

1.05 SUBMITTALS

- A. Product Data: For each type and size of sectional overhead door and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:
 - 1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
 - 2. Summary of forces and loads on walls and jambs.
- B. Shop drawings for special components and installations which are not fully dimensioned or detailed on manufacturer's data sheets. Shop drawings for each type door installation and for special components and installations not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work including details and attachment of steel door track guards.

1. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.
- C. Samples for verification of each type of exposed finish required, prepared on 6 inch lengths and of same thickness and material indicated for Work.
- D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

1.06 QUALITY ASSURANCE

- A. Installer's Qualifications: Engage an experienced installer who is an authorized representative of the sectional overhead door manufacturer for both installation and maintenance of units required for this Project.
- B. Manufacturer's Qualifications: Engage a firm experienced in manufacturing sectional overhead doors similar to those indicated for this Project and with a record of successful in-service performance.
- C. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.
 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

1.07 EXTRA STOCK

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents:
 1. Furnish five (5) replacement door panels.
 2. Furnish two (2) spare tracks.
 3. Furnish four (4) spare hinges.
 4. Furnish five (5) spare rollers.
 5. Furnish two (2) spare slide bolts.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Basis of Design: "Model 524S"; Clopay Building Products Co. Subject to compliance with requirements, equivalent doors by one of the following are also acceptable:

1. Omega.
2. Raynor Garage Doors.
3. Roll-Lite Door Corp.
4. Wayne-Dalton Corp.
5. Windsor Door.
6. C.H.I. Overhead Doors.
7. Haas Door.

2.02 STEEL SECTIONS

- A. Construct door sections from galvanized, structural quality carbon steel sheets complying with ASTM A 653, commercial quality, with a minimum yield strength of 33,000 psi and a minimum G60 zinc coating.
 1. Steel Sheet Thickness: 24 gage.
 2. Exterior Section Face: Ribbed.
- B. Fabricate door panels from a single sheet to provide sections not more than 24 inches high and nominally 2 inches deep. Roll horizontal meeting edges to a continuous, interlocking, tongue-in-groove weathertight seal, with a reinforcing flange return.
 1. Insulation: 1-3/8 inch thick polystyrene board with a prepainted 30 gage steel backcover. R value of 6.6.
- C. Enclose open section with not less than 16 gage galvanized steel channel end stiles welded in place. Provide not less than 18 gage galvanized intermediate stiles, cut to door section profile, spaced at not more than 48 inches o.c. and welded in place.
- D. Reinforce bottom section with a continuous channel or angle conforming to bottom section profile and allowing installation of astragal.
- E. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized steel bars, struts, trusses or strip steel, formed to depth and bolted or welded in place.
- F. Provide reinforcement for hardware attachment.
- G. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints, and free of warp, twist, and deformation.
- H. Finish galvanized steel door sections as follows:
 1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2. Surface Preparation: Clean galvanized surfaces with nonpetroleum solvent so surfaces are free of oil and surface contaminants.
3. Pretreat zinc-coated steel, after cleaning, with a conversion coating of type suited to organic coating applied over it.
4. Apply manufacturer's standard primer and finish coats to interior and exterior door faces after forming, according to coating manufacturer's written instructions for application, thermosetting, and minimum dry film thickness.
 - a. Colors: Exterior color to match Benjamin Moore "#812 Blue." Interior color to match Benjamin Moore's.

2.03 TRACKS, SUPPORTS, AND ACCESSORIES

- A. Tracks: Provide manufacturer's heavy duty galvanized steel track system, sized for door size and weight, and designed for lift type indicated and clearances shown, and complying with ASTM A 653, for minimum G60 zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track at 2 inches o.c. for door-drop safety device. Slope tracks at proper angle from vertical or otherwise design to ensure tight closure at jambs when door unit is closed. Weld or bolt to track supports.
 1. Provide minimum 14 gauge tracks.
 2. Provide track guard for track impact protection. Track guards shall be furnished by the door manufacturer and shipped together with other door components. Track guard to be a minimum of 48 inch tall 1/4 inch thick bent steel plate full welded to 1/4 inch thick steel base plate. Attach base plate to concrete floor slab so that track guard assembly can withstand the impact of a 10,000 lb. vehicle traveling at speeds up to 4 mph.
- B. Track Reinforcement and Supports: Provide galvanized steel track reinforcement and support members, complying with ASTM A 36 and ASTM A 123. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.
- C. Support and attach tracks to opening jambs with continuous angle welded to tracks and attached to wall. Support horizontal (ceiling) tracks with continuous angle welded to track and supported by laterally braced attachments to overhead structural members at curve and end of tracks.

- D. Weatherseals: Provide replaceable, adjustable, continuous, compressible weatherstripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and at top of overhead door.
 - 1. In addition, provide continuous flexible seals at door jambs for a weathertight installation.
- E. Steel Section Ventilation Gates: Fabricate door sections from commercial quality steel. Fabricate frames from 1 inch by 2 inch by 14 gage steel tube, miter cut and welded. Provide section panels with 16 gate diamond-shaped expanded steel openings, 1/2 inch square, welded to steel frame. Integral 1 inch by 1 inch by 11 gage angle welded horizontally as required by gate size for additional support and security. Provide flat meeting rails.
 - 1. Product/Manufacturer: "Model 801"; Clopay.
 - 2. Size: As indicated on Drawings.
 - 3. Finish: Manufacturer's standard baked polyester enamel. Colors as indicated on Drawings.
 - 4. Hardware: Operation and hardware components similar to vertical lift sectional door. Provide dual track.
- F. Safety Stops: Provide safety stop system for overhead door/ventilation gate assemblies. Locking latch travels with door to automatically activate the "lock-down" feature. Integral handle for manual operation.
 - 1. Product/Manufacturer: "Door Deputy Lock-Down System" WITH "Quick-Flex" handle; Rite-Hite Corporation.

2.04 HARDWARE

- A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless steel, or other corrosion-resistant fasteners, to suit door type.
- B. Hinges: Provide heavy-duty galvanized steel hinges, not less than 0.0747 inch thick uncoated steel, at each end stile and at each intermediate stile, per manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges, where required, for doors exceeding 16 feet in width, unless otherwise recommended by door manufacturer.

- C. Rollers: Provide heavy-duty rollers, with steel ball bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch diameter roller tires for 3 inch track, and as follows:
 - 1. Case-hardened steel tires.
- D. Push/Pull Handles: Manufacturer's standard.
- E. Slide Bolt: Fabricate with side locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.
 - 1. Locking Bars: Single-jamb side, operable from inside only.
- F. Where door unit is power operated, provide safety interlock switch to disengage power supply when door is locked.
- G. Use lock nuts and/or lock washers throughout.

2.05 COUNTERBALANCING MECHANISM

- A. Extension Spring: Operation by extension -spring counterbalance mechanism with aircraft-type steel cable over ball-bearing sheaves. Provide oil-tempered wired springs with internal safety rods.
- B. Torsion Spring: Operation by torsion-spring counterbalance mechanism consisting of adjustable-tension springs, fabricated from oil-tempered-steel wire complying with ASTM A 229, Class II, mounted on a cross -header tube or steel shaft. Connect to door with galvanized aircraft-type lift cables with cable safety factor of at least 5 to 1. Provide springs calibrated for 25,000 cycles minimum.
- C. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side, designed to automatically stop door if either cable breaks.
- D. Bracket: Provide anchor support bracket, as required to connect stationary end of spring to the wall, to level shaft and prevent sag.
- E. Provide a spring bumper at each end of horizontal or vertical track to cushion door and/or gate at end of opening operation.

2.06 MANUAL DOOR OPERATION

- A. Push-Up Operation: Provide lift handles and nonrotting 1/2 inch diameter nylon pull rope for raising and lowering doors, operating with not more than 25 lbf lift or pull.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine wall and overhead areas, including opening framing and blocking, with Installer present, for compliance with requirements for installation tolerances, clearances, and other conditions affecting performance of Work of this Section.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Install door, track, and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts,

hangers, and equipment supports according to shop drawings, manufacturer's written instructions, and as specified.

- B. Fasten vertical track assembly to wall construction at not less than 24 inches o.c., and as indicated on Drawings. Hang horizontal track from structural overhead framing with angle or channel hangers welded and bolt fastened in place. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door operating equipment.
- C. Fasten vertical track assembly to concrete floor slab. Provide an additional wall bracket at bottom of track. Rotate wall bracket and attach one end to the track and anchor the other end to the concrete floor slab.

3.03 ADJUSTING

- A. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

3.04 DEMONSTRATION

- A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:
 - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
 - 3. Review data in the maintenance manuals. Refer to Section 01770 "Contract Closeout."
 - 4. Startup services shall also include a one year service and maintenance agreement with service and maintenance provided quarterly.

END OF SECTION 08361

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SECTION 08710

DOOR HARDWARE

PART I - GENERAL

1.01 SUMMARY

- A. Provide door hardware as indicated on the Drawings and specified herein.
- B. Related Sections:
 - 1. Section 08110 "Steel Doors and Frames."

1.02 SUBMITTALS

- A. Product Data: Submit manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
- B. Final Hardware Schedule: Coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
 - a. Type, style, hand, function, size, and finish of each hardware item.
 - b. Name and manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of each hardware set cross referenced to indications on Drawings both on floor plans and in door and frame schedule.
 - e. Explanation of all abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for hardware.
 - g. Door and frame sizes and materials.
 - h. Keying information.

2. Submittal Sequence: Submit final schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the Project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.
 3. Keying Schedule: By Owner.
- C. Templates: For doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.03 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer.
- B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that employs an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.
1. Require supplier to meet with Owner to finalize keying requirements and to obtain final instructions.

1.04 PRODUCT HANDLING

- A. Tag each item or package separately, with identification related to final hardware schedule, and include basic installation instructions with each item or package.
- B. Packaging of hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.
- C. Inventory hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that the count is correct.
- D. Deliver individually packaged hardware promptly to the place of installation (shop or project site).

- E. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items which are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

1.05 MAINTENANCE

- 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.

1.06 WARRANTY

- A. Warrant door closers for period of five years from date of Certificate of Occupancy.

PART 2 - PRODUCTS

2.01 SCHEDULED HARDWARE

- A. Requirements for design, grade, function, finish, size and other distinctive qualities of each type of finish hardware are specified herein and in the "Door Hardware Schedule" at the end of this Section. Products are identified by using manufacturer's hardware designation numbers of the following:
 - 1. Manufacturer's Product Designations: The product designation and name of one manufacturer are listed for each hardware type required for the purpose of establishing minimum requirements. Provide either the product designated, or, where more than one manufacturer is specified in Part 2 for each hardware type, the comparable product of one of the other manufacturers that complies with requirements.

2.02 MATERIALS AND FABRICATION

- A. Manufacturer's Name Plate: Do not use manufacturer's products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise acceptable to Architect.
 - 1. Manufacturer's identification will be permitted on rim of lock cylinders only.
- B. Base Metals: Produce hardware units of basic metal and forming method indicated using manufacturer's standard metal alloy, composition, temper, and hardness, but in not case of lesser (commercially recognized) quality than specified for applicable hardware units for finish designations indicated.

- C. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.
- D. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" in surfaces to receive painted finish.
- E. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of the type specified are available with concealed fasteners. Do not use through-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of reinforcing the work adequately to fasten the hardware securely. Where through-bolts are used as a means of reinforcing the work, provide sleeves for each through-bolt or use sex screw fasteners.

2.01 HARDWARE FINISHES

- A. The designations used in schedules and elsewhere to indicate hardware finishes are the industry-recognized standard commercial finishes, except as otherwise noted.

2.02 HINGES AND PIVOTS

- A. Exterior Butt Hinges: Stainless steel. On all out swinging doors, furnish hinges with non-removable pins (NRP).
- B. Interior Butt Hinges: As scheduled.
- C. No. of Hinges: Doors 60 inches or less in height shall have two (2) butt hinges. Furnish one (1) additional butt hinge for each 30 inches in height or fraction thereof.
- D. Basis of Design: Ives.
 - 1. Other Acceptable Manufacturers: Hager; Stanley.

2.03 KEYING

- A. Cylinders, keying, and keys shall be Medeco supplied by the Owner.

2.04 LOCKSETS

- A. Lockset Design: Heavy duty cylindrical type, unless otherwise specified.
 - 1. Basis of Design: "ND Series" and "AL Series" as manufactured by Schlage Lock. NO substitution is permissible.
- B. Electric Locks: Schlage ND80PD-EU 24VDC. Power supply by security integrator.

2.05 EXIT DEVICES

- A. All devices in types and functions specified. All devices must be listed under "Panic Hardware" in accident equipment list of Underwriters Laboratories (UL). All labeled doors with "Fire Exit Hardware" must have labels attached and be in strict accordance with UL.
 - 1. Basis of Design: "89 Series"; Von Duprin. NO substitution is permissible.
- B. All exit devices shall be tested to ANSI/BHMA A156.3 test requirements by a BHMA certified testing laboratory. Provide a written certification showing successful completion of a minimum of 1,000,000 cycles.
- C. Surface Strikes: Roller type; complete with a plate underneath to prevent movement. Include integral dead-latching feature to prevent latchbolt tampering.

2.06 DOOR CLOSERS

- A. Provide all closers with non-ferrous covers, forged steel arms separate valves for adjusting backcheck, closing and latching cycles and adjustable spring to provide up to 50 percent increase in spring power. Furnish closers with parallel arm mounted on all doors opening into corridors or other public spaces and mounted to permit 180 degrees door swing wherever wall conditions permit. Furnish with non-hold open arms unless otherwise indicated.
 - 1. Basis of Design: "4111 EDA Series"; LCN Closers. NO substitution is permissible.
 - 2. Thru-bolt door closers, using sex bolts, for all closer installations including hollow metal doors, solid wood core doors, and aluminum doors.

- B. Provide door closer cylinders of high strength cast iron construction to provide low wear operating capabilities of internal parts throughout life of installation. All door closers tested to ANSI/BHMA A156.4 test requirements by a BHMA certified testing laboratory. Provide a written certification showing successful completion of a minimum of 10,000,000 cycles.
- C. Door closers shall utilize temperature stable fluid capable of withstanding temperature ranges of 120 deg F to -30 deg F, without requiring seasonal adjustment of closer speed to properly close the door. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with UL 10C.
- D. Door closers shall incorporate tamper resistant non-critical screw valves of V-slot design to reduce possible clogging from particles within the closer. Closers shall have separate and independent screw valve adjustments for latch speed, general speed, and hydraulic backcheck. Backcheck shall be properly located so as to effectively slow the swing of the door at a minimum of 10 degrees in advance of the dead stop location to protect the door frame and hardware from damage. Pressure relief valves (PRV) are not acceptable.

2.07 TRIM AND PLATES

- A. Kick plates, mop plates, and armor plates, shall be .050 gauge with US32D finish. Kick plates shall be 10 inches high, mop plates shall be 4 inches high. All plates shall be 2 inches less full width of door.
- B. Push plates, pull plates, door pulls, and miscellaneous door trim shall be shown in the hardware schedule.
- C. Basis of Design: Ives.
 - 1. Other Acceptable Manufacturers: Hager; Rockwood.

2.08 DOOR STOPS

- A. Provide door stops for all doors to prevent damage to doors or hardware from striking adjacent walls or fixtures.
 - 1. Basis of Design: "WS407 Series" wall bumpers; Ives. Where not practical, provide Ives "FS436 Series" or "FS438 Series" floor stops.
 - 2. Other Acceptable Manufacturers: Hager; Rockwood.

- B. Where conditions prohibit the use of either wall or floor type stops, provide surface-mounted overhead stops.
 - 1. Basis of Design: "450 Series"; Glynn Johnson.
 - 2. Other Acceptable Manufacturer: Rixson.

2.10 THRESHOLDS AND WEATHERSTRIP

- A. Thresholds and weatherstrip shall be as listed in the hardware schedule.
- B. Basis of Design: National Guard. Pemko is also acceptable.

2.11 DOOR SILENCERS

- A. Provide rubber door silencers for all interior hollow metal frames; two (2) per pair and three (3) per single door frame.
 - 1. Basis of Design: "SR64"; Ives.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install all hardware according to Finish Hardware Schedule. Exercise care not to mar or damage adjacent work.

3.02 ADJUSTING AND CLEANING

- A. Adjust all hardware according to manufacturer's published instructions. Prior to turning Project over to Owner, clean hardware and make final adjustments as necessary.

3.03 PROTECTION

- A. Protect hardware stored on Project site in a covered and dry place.
- B. Protect exposed hardware installed on doors during the remainder of the construction period.

3.04 DOOR HARDWARE SCHEDULE

Hardware Group No. 01 – Exterior Door

Provide each SGL door with the following:

3 Ea.	Hinge	Ives 3PB1 4.5 x 4.5 NRP x 652 Finish
1 Ea.	Panic Hardware	Von Duprin 98 EO Series x 626 Finish
1 Ea.	Surface Closer	LCN 1461 CUSH x 689 Finish
1 Ea.	Kick Plate	Ives 8400 10" x 2" LDW B4E x 630 Finish
1 Ea.	Rain Drip	Zero 142A x AL Finish
1 Set	Weather Seal	Zero 188S x BLK Finish
1 Ea.	Threshold	Zero 65A MSLA-10 x AL Finish

Hardware Group No. 02 – Exterior Door with Access Control

Provide each SGL door with the following:

2 Ea.	Hinge	Ives 3CB1 4.5 x 4.5 NRP x 630 Finish
1 Ea.	Electric Hinge	Ives 3CB1 Electric 4.5 x 4.5 NRP x 630 Finish
1 Ea.	Electric Panic Hardware	Von Duprin 98-L-E996-06-FS x 626 Finish
1 Ea.	Surface Closer	LCN 1461 CUSH x 689 Finish
1 Ea.	Kick Plate	Ives 8400 10" x 2" LDW B4E x 630 Finish
1 Ea.	Rain Drip	Zero 142A x AL Finish
1 Set	Weather Seal	Zero 188S x BLK Finish
1 Ea.	Threshold	Zero 65A MSLA-10 x AL Finish

Card Readers to be supplied by security vendor.

Wiring Diagrams to be provided by hardware vendor.

Hardware Group No. 03 – Restroom Doors

Provide each SGL door with the following:

3 Ea.	Hinge	Ives 3CB1 4.5 x 4.5 x 652 Finish
1 Ea.	Push Plate	Ives 8200 6" w x 16" T x 630 Finish
1 Ea.	Pull Plate	Ives 8203 6" w x 16" T x 630 Finish
1 Ea.	Surface Closer	LCN 1461 x 689 Finish
1 Ea.	Kick Plate	Ives 8400 10" x 2" LDW B4E x 630 Finish
1 Ea.	Wall Stop	Ives WS406CCV x 630 Finish
3 Ea.	Silencers	Ives SR64 x Grey

Hardware Group No. 06 – Janitor's Closet

Provide each SGL door with the following:

3 Ea.	Hinge	Ives 3PB1 4.5 x 4.5 x 652 Finish
1 Ea.	Storeroom Lockset	Schlage AL80PD SAT x 626 Finish
1 Ea.	Kick Plate	Ives 8400 10" x 2" LDW B4E x 630 Finish
1 Ea.	Wall Stop	Ives WS406CCV x 630 Finish
3 Ea.	Silencers	Ives SR64 x Grey

END OF SECTION 08710

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SECTION 09255

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Non-load-bearing steel framing members for gypsum board assemblies.
 - 2. Gypsum board assemblies attached to steel framing.
 - 3. Cementitious backer units installed with gypsum board assemblies.

1.02 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A118.9: Cementitious Backer Units (CBU).
- B. ASTM International (ASTM):
 - 1. ASTM A 653: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM C 36: Specification for Gypsum Wallboard.
 - 3. ASTM C 475: Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - 4. ASTM C 630: Specification for Water-Resistant Gypsum Backing Board.
 - 5. ASTM C 645: Specification for Nonstructural Steel Framing Members.
 - 6. ASTM C 665: Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - 7. ASTM C 754: Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 - 8. ASTM C 834: Specification for Latex Sealants.
 - 9. ASTM C 840: Specification for Application and Finishing of Gypsum Board.
 - 10. ASTM C 919: Standard Practice for Use of Sealants in Acoustical Applications.

11. ASTM C 1002: Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 12. ASTM C 1047: Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 13. ASTM D 226: Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 14. ASTM E 90: Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 15. ASTM E 413: Classification for Rating Sound Insulation.
- C. Gypsum Association (GA):
1. GA-214: Recommended Levels of Gypsum Board Finish.
 2. GA-216: Application and Finishing of Gypsum Board.

1.03 ASSEMBLY PERFORMANCE REQUIREMENTS

- A. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those of assemblies whose STC ratings were determined according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

1.04 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Product Certificates: Signed by manufacturers of gypsum board assembly components certifying that their products comply with specified requirements.
- C. Textured Finish Samples: 12 inch by 12 inch or larger size for each textured finish indicated and on same backing indicated for Work.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum boards flat to prevent sagging.

1.06 PROJECT CONDITIONS

- A. Environmental Conditions, General: Establish and maintain environmental conditions for application and finishing gypsum board to comply with ASTM C 840 requirements or gypsum board manufacturer's recommendations, whichever are more stringent.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, products by the following:
 - 1. Steel Framing and Furring:
 - a. Dale Industries, Inc.
 - b. Dietrich Industries, Inc.
 - c. Gold Bond Building Products.
 - d. Marino/Ware.
 - e. Unimast, Inc.
 - 2. Gypsum Board and Related Products:
 - a. GP Gypsum Corp.
 - c. National Gypsum Company.
 - d. United States Gypsum Co.

2.02 STEEL FRAMING FOR WALLS AND PARTITIONS

- A. General: Provide steel framing members complying with the following requirements:
 - 1. Protective Coating: ASTM A 653, G40 hot-dip galvanized coating.
- B. Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 degrees and doubled over to form 3/12 inch wide minimum lip (return) and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:
 - 1. Thickness: 0.0359 inch, unless otherwise indicated.
 - 2. Depth: 3-5/8 inches, unless other indicated.
- C. Steel Rigid Furring Channels: ASTM C 645, hat shaped, depth and minimum thickness of base (uncoated) metal as follows:
 - 1. Thickness: 0.0359 inch, unless otherwise indicated.
 - 2. Depth: 7/8 inch.

- D. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

2.03 GYPSUM BOARD PRODUCTS

- A. General: Provide gypsum board of types indicated in maximum lengths available that will minimize end-to-end butt joints in each area indicated to receive gypsum board application.
 - 1. Widths: Provide gypsum board in widths of 48 inches.
- B. Gypsum Wallboard: ASTM C 36, and as follows:
 - 1. Type: Regular for vertical surfaces, unless otherwise indicated.
 - 2. Edges: Tapered.
 - 3. Thickness: 5/8 inch, unless otherwise indicated.
- C. Water-Resistant Gypsum Backing Board: ASTM C 630 and as follows:
 - 1. Type: Regular, unless otherwise indicated.
 - 2. Thickness: 5/8 inch.
 - 3. Use: In Toilet Rooms and Janitor Closets, if required or indicated.

2.04 CEMENTITIOUS BACKER UNITS

- A. Provide cementitious backer units complying with ANSI A118.9, of thickness and width indicated below, and in maximum lengths available to minimize end-to-end butt joints.
 - 1. Thickness: 5/8 inch.
 - 2. Width: Manufacturer's standard width but not less than 32 inches.
 - 3. Use: 4'-0" high backer units in Toilet Rooms.
- B. Products: Subject to compliance with requirements, provide one of the following products:
 - 1. "The Original Wonderboard"; Custom Building Products.
 - 2. "DomCrete Cementitious Tile-Backer Board"; Domtar Gypsum.
 - 3. "DUROCK Cement Board"; United States Gypsum Co.

2.05 TRIM ACCESSORIES

- A. Accessories for Interior Installation: Cornerbead, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:
 - 1. Material: Formed metal or plastic, with metal complying with the following requirement:
 - a. Sheet steel zinc-coated by hot-dip process or rolled zinc.

2. Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047:
 - a. Cornerbead on outside corners, unless otherwise indicated.
 - b. L-bead with face flange only; face flange formed to receive joint compound. Use L-bead where indicated.

2.06 JOINT TREATMENT MATERIALS

- A. General: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.
- B. Joint Tape for Gypsum Board: Paper reinforcing tape, unless otherwise indicated.
 1. Use pressure-sensitive or staple-attached, open-weave glass fiber reinforcing tape with compatible joint compound where recommended by manufacturer of gypsum board and joint treatment materials for application indicated.
- C. Joint Tape for Cementitious Backer Units: As recommended by cementitious backer unit manufacturer.
- D. Setting-Type Joint Compound for Gypsum Board: Factory-prepackaged, job-mixed, chemical-hardening powder products formulated for uses indicated.
 1. Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.
 2. For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer for this purpose.
 3. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by the gypsum board manufacturer for this purpose.
 4. For topping compound, use sandable formulation.
- E. Drying-Type Joint Compounds for Gypsum Board: Factory-prepackaged vinyl-based products complying with the following requirements for formulation and intended use.
 1. Ready-Mix Formulation: Factory-mixed product.
 - a. Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.
 - b. Topping compound formulated for fill (second) and finish (third) coats.
 - c. All-purpose compound formulated for both taping and topping compounds.

2. Job-Mixed Formulation: Powder product for mixing with water at Project site.
 - a. Taping compound formulated for embedding tape and for first coat over fasteners and flanges and flange faces of trim accessories.
 - b. Topping compound formulated for fill (second) and finish (third) coats.
 - c. All-purpose compound formulated for use as both taping and topping compounds.
- F. Joint Compound for Cementitious Backer Unit: Material recommended by cementitious backer unit manufacturer.

2.07 ACOUSTICAL SEALANT

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following requirements:
 1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- B. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.
- C. Products: Subject to compliance with requirements, provide the following:
 1. Acoustical Sealant for Exposed and Concealed Joints:
 - a. "SHEETROCK Acoustical Sealant"; United States Gypsum Co.

2.08 MISCELLANEOUS MATERIALS

- A. General: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.
- B. Spot Grout: ASTM C 475, setting-type joint compound of type recommended for spot grouting hollow metal door frames.
- C. Steel drill screws complying with ASTM C 1002.

- D. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
- E. Sound Attenuation Blankets: Unfaced mineral-fiber blanket insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type I (blankets without membrane facing):
 - 1. Mineral Fiber Type: Fibers manufactured from glass, slag wool, or rock wool.
- F. Fiberglass-Reinforced Plastic Paneling: Provide over room walls where indicated on Drawings. Install as recommended by paneling manufacturer.
 - 1. Product/Manufacturer: "Glasbord"; Kemlite Company.

2.09 TEXTURE FINISHES

- A. Products: Subject to compliance with requirements, provide one of the following:
 - 1. "GyProc Vermiculite Ceiling Texture"; G-P Gypsum Corp.
 - 2. "SHEETROCK Wall and Ceiling Spray Texture (Aggregated)"; United States Gypsum Co.
- B. Primer: As recommended by textured finish manufacturer.
- C. Aggregate Finish: Water-based, job-mixed, aggregated, drying-type texture finish for spray application.
 - 1. Texture: Orange peel.

PART 3 - EXECUTION

3.01 INSTALLING STEEL FRAMING, GENERAL

- A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and ASTM C 840 requirements that apply to framing installation.
- B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with "Gypsum Construction Handbook" published by United States Gypsum Co.

3.02 INSTALLING STEEL FRAMING FOR WALLS AND PARTITIONS

- A. Install runners (tracks) at floors, ceilings and structural walls and columns where gypsum board stud assemblies abut other construction.
 - 1. Where studs are installed directly against exterior walls, install asphalt felt strips or foam gaskets between studs and wall.
- B. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch from plane formed by the faces of adjacent framing.
- C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
 - 1. Cuts studs 1/2 inch short of full height to provide perimeter relief.
- D. Install steel studs and furring in sizes and at spacings indicated.
 - 1. Single Layer Construction: Space studs 16 inches o.c., unless otherwise indicated.
- E. Frame door openings to comply with applicable published recommendations of gypsum board manufacturer, unless otherwise indicated. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - 1. Install 2 studs at each jamb, unless otherwise indicated.
 - 2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2 inch clearance from jamb stud to allow for installation of control joint.
 - 3. Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above.
- F. Frame openings other than door openings to comply with details indicated or, if none indicated, as required for door openings. Install framing below sills of openings to match framing required above door heads.

3.03 APPLYING AND FINISHING GYPSUM BOARD, GENERAL

- A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840 and GA-216.
- B. Install sound attenuation blankets where indicated prior to installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

- C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- D. Install gypsum panels with face side out. Do not install imperfect, damaged or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between boards. Do not force into place.
- E. Locate both edge or 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 over different studs on opposite sides of partitions. Avoid joints at corners of framed openings where possible.
- F. Attach gypsum panels to steel studs so that the leading edge or end of each panel is attached to open (unsupported) edge of stud flanges first.
- G. Attach gypsum panels to framing provided at openings and cutouts.
- H. Spot grout hollow metal door frames for solid core wood doors, hollow metal doors, and doors over 32 inches wide. Apply spot grout at each jamb anchor clip and immediately insert gypsum panels into frames.
- I. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chase walls that are braced internally.
 - 1. Except where concealed application is indicated or required for sound 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.
- J. Where STC-rated gypsum board assemblies are indicated, seal construction at perimeters, behind control and expansion joints, openings, and penetrations with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with ASTM C 919 and manufacturer's recommendations for location of edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
- K. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.

3.04 GYPSUM BOARD APPLICATION METHODS

- A. Single-Layer Application: Install gypsum wallboard panels as follows:
 - 1. On partition/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated, and provide sheet lengths that will minimize end joints.
- B. Single-Layer Fastening Methods: Apply gypsum panels to supports as follows:
 - 1. Fasten with screws.

3.05 INSTALLING TRIM ACCESSORIES

- A. General: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.
- B. Install corner beads at external corners.
- C. Install edge trim where edge of gypsum panels would otherwise be exposed. Provide edge trim type with face flange to receive joint compound, except where other types are indicated.

3.06 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, flanges of corner beads, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.
- B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.
- C. Apply joint tape over gypsum board joints and to flanges of trim accessories as recommended by trim accessory manufacturer.
- D. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214.
 - 1. Level 2 where panels form substrates for tile or FRP and where indicated.
 - 2. Level 4 for gypsum board surfaces, unless otherwise indicated.
- E. Use the following joint compound combination as applicable to the finish levels specified:
 - 1. Embedding and First Coat: Setting-type joint compound.

2. Fill (Second) Coat: Setting-type joint compound.
 3. Finish (Third) Coat: Setting-type joint compound.
- F. For Level 4 gypsum board finish, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.
- G. Where Level 2 gypsum board finish is indicated, embed tape in joint compound and apply first coat of joint compound.

3.07 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.
- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture finish manufacturer's written recommendations.

3.08 CLEANING AND PROTECTION

- A. Promptly remove any residual joint compound from adjacent surfaces.
- B. Provide final protection and maintain conditions, in a manner suitable to Installer, that ensure gypsum board assemblies are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 09255

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SECTION 09310

TILE

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Ceramic tile for floor applications.
 - 2. Accessory materials for flooring transitions.
- B. Related Sections:
 - 1. Section 03300 "Cast-in-Place Concrete" for monolithic slab finishes specified for tile substrates.
 - 2. Section 07920 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.02 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A108 Series: Specifications for Installation of Ceramic Tile.
 - 2. ANSI A118.4: Specifications for Latex-Portland Cement Mortar.
 - 3. ANSI A118.6: Specifications for Standard Cement Grouts for Tile Installation.
 - 4. ANSI A137.1: Specifications for Ceramic Tile.
- B. ASTM International (ASTM):
 - 1. ASTM C 920: Specification for Elastomeric Joint Sealants.

1.03 SUBMITTALS

- A. Product Data: For each type of tile, mortar, grout, and other products specified.
- B. Samples for Verification: Mount two full-size tile units with grouted joint on plywood backing panel to illustrate color, pattern, and grout joint size.
- C. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- D. Product Certificates: Signed by manufacturers certifying that the products furnished comply with requirements.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: An Installer who has completed tile installations similar to requirements for this Project, with a minimum of five years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A 137.1 for labeling sealed tile packages.
- B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is completed and ambient and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

1.07 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials in the amount of two percent of each tile size, color, and pattern required for Project.

PART 2 - PRODUCTS

2.01 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI 137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard Grade requirements.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting Materials" and "Grouting Materials" articles.
- C. Colors, Textures, and Patterns: As specified herein. Provide tile trim and accessories that match color and finish of adjoining flat tile

2.02 TILE PRODUCTS

- A. Ceramic Tile:
 - 1. Product/Manufacturer: "Shadow Bay"; American Olean
 - a. Moisture Absorption: 0.5 percent or less.
 - 2. Module Size: 12 inches by 12 inches.
 - 3. Thickness: 3/8 inch.
 - 4. Edges: Cushioned.
 - 5. Surface Finish: Matte.
 - 6. Colors: As indicated on Drawings.
 - 7. Trim Units: Matching bullnose shapes in 3 inch by 12 inch size for base.

2.03 TRIM AND ACCESSORIES

- A. Thresholds: Anodized aluminum transition strip. Basis of Design: Genotek "Code 660" or Owner approved equal. Thresholds units free from holes, cracks, or open seams. Install at doorways where tile terminates.

2.04 SETTING MATERIALS

- A. Latex-Portland Cement Mortar: ANSI A118.4. Mixture of prepackaged, dry mortar mix and liquid latex additive.

2.05 GROUTING MATERIALS

- A. Latex-Portland Cement Grout: ANSI A 118.6. Mixture of factory-prepared, dry grout mix and latex additive.
 - 1. Color: Mapei Corporation's "#10 Black."

2.06 ELASTOMERIC SEALANTS

- A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with requirements of Section 07920 "Joint Sealants."
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.
- C. One-Part Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and temperature extremes. Provide one of the following:

1. "Dow Corning 786"; Dow Corning Corporation.
 2. "Sanitary 1700"; GE Silicones.
 3. "Pecora 898 Sanitary Silicone Sealant"; Pecora Corp.
 4. "Tremsil 600 White"; Tremco, Inc.
- D. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O. Provide one of the following:
1. "Chem-Calk 550"; Bostik.
 2. "Vulkem 245"; Tremco, Inc.
 3. "NR-200 Urexpan"; Pecora Corp.
 4. "THC-900"; Tremco, Inc.

2.07 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- C. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout. Provide one of the following grout sealers:
1. "CeramaSeal Grout & Tile Sealer"; Bostik, Inc.
 2. "Surfaceguard"; Custom Building Products.
 3. "KER"; Mapei Corporation.
 4. "Silicone Grout Sealer"; Southern Grouts & Mortars, Inc.

2.08 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with requirements of referenced standards and mortar and grouts manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.
 - 2. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust latter in consultation with Architect.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Remove coatings, including curing compounds, and other substances that contain soap, wax, oil, or silicone and are incompatible with tile-setting materials by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.
- B. Provide concrete substrates for tile floors installed with latex-portland cement mortars that comply with flatness tolerances specified in referenced ANSI A108 series of tile installation standards for installations indicated.
 - 1. Use trowelable leveling and patching compounds per tile-setting material manufacturer's written instructions to fill cracks, holes, and depressions.
 - 2. Remove protrusions, bumps, and ridges by sanding or grinding.
- C. Blending: For tile exhibiting color variations within the ranges selected during sample submittals, verify that tile has been blended in the factory and packaged so tile units taken from one package show the same range in colors as those taken from other packages and match approved samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.03 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standard: Comply with parts of ANSI 108 series of tile installation standards in "Specifications for the Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- B. TCA Installation Guide: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions unless otherwise shown. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, and trim are the same size. Lay out tile work and center tile fields in both directions in each space. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
- F. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw cut joints after installing tiles.
 - 1. Locate joints in tile surfaces directly above joints in concrete substrates.
 - 2. Prepare joints and apply sealants to comply with requirements of Section 07920 "Joint Sealants."
- G. Grout tile to comply with the requirements of the following installation standards:
 - 1. For ceramic tile grouts, comply with ANSI A 108.10.

3.04 FLOOR TILE INSTALLATION

- A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 series of tile installation standards.
- B. Joint Widths: Install tile on floors with the following joint widths:
 - 1. Paver Tile: 1/4 inch.
- C. Grout Sealer: Apply grout sealer to grout joints in tile floors according to grout sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.05 CLEANING AND PROTECTING

- A. Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove latex-portland cement grout residue from tile as soon as possible.
 - 2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
- B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure tile is without damage or deterioration at the time of Substantial Completion.
 - 1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
 - 2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.06 FLOOR TILE INSTALLATION SCHEDULE

- A. Floor Tile Installation: Comply with the following:
 - 1. Tile Type: Unglazed ceramic mosaic tile and unglazed paver tile.
 - 2. Installation Method: TCA F113 (thin-set mortar bonded to concrete slab).
 - 3. Setting Bed and Grout: ANSI A108.5 with the following mortar and grout:
 - a. Latex-portland cement mortar.
 - b. Unsanded latex-portland cement grout.

END OF SECTION 09310

SECTION 09511

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes ceilings consisting of acoustical panels and exposed suspension systems.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM A 641: Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - 2. ASTM C 635: Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
 - 3. ASTM C 636: Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
 - 4. ASTM C 834: Specification for Latex Sealants.
 - 5. ASTM E 90: Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

1.03 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Samples for Verification: Full-size units of each type of ceiling assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
 - 1. 6 inch square samples of each acoustical panel type, pattern, and color.
 - 2. Set of 12 inch long samples of exposed suspension system members, including moldings, for each color and system type required.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed acoustical panel ceilings similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install interior acoustical panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is completed and dry, work above ceilings is complete, and ambient temperature and humidity conditions are being maintained at the levels indicated for Project when occupied for its intended use.

1.07 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components, and partition assemblies.

1.08 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.
 - 1. Acoustical Ceiling Units: Full-size units equal to 2.0 percent of amount installed.
 - 2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products: Provide products as indicated in the Acoustical Panel Ceiling Schedule at the end of Part 3.

2.02 ACOUSTICAL PANELS, GENERAL

- A. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
- B. Antimicrobial Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial solution consisting of a synergistic blend of substituted ammonium salts of alkylated phosphoric acids admixed with free alkylated phosphoric acid that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria.

2.03 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.
- B. Provide manufacturer's standard factory-applied finish for type of system indicated.
- C. Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated Carbon Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so that stress at 3 times hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 0.106 inch diameter wire.
- E. Sheet Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.
 - 1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 - 2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
 - 3. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.

- F. Impact Clips: Where indicated, provide manufacturer's standard impact clip system design to absorb impact forces against acoustical panels.

2.04 ACOUSTICAL SEALANT

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and ASTM E 90:
 - 1. Product/Manufacturer:
 - a. "PL Acoustical Sealant"; Chemrex, Inc., Contech Brands.
 - b. "AC-20 FTR Acoustical and Insulation Sealant"; Pecora Corp.
 - c. "SHEETROCK Acoustical Sealant"; United States Gypsum Company.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this Section and other sections that affect ceiling installation and anchorage, and other conditions affecting performance of acoustical panel ceilings.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half-width panels at borders and conform to the layout shown on reflected ceiling plans.

3.03 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with publications referenced below per written manufacturer's instructions and CISCA "Ceiling Systems Handbook."
 - 1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.

- B. Suspend ceiling hangers from building's structural members and as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system.
 2. Splay hangers only where required and to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of 3 tight turns. Connect hangers either directly to structures or to inserts, eye screws, or other devices that are secure, that are appropriate for substrate, and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 6. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise shown, and provide hangers not more than 8 inches from ends of each member.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of 4 tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to steel deck or steel deck tabs.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not over 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, kinked, or scratched suspension system members.
- F. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide neat, precise fit.
 - 1. Arrange directionally patterned acoustical panels as indicated on reflected ceiling plans.
 - 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
 - 3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 - 4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
 - 5. Paint the cut panel edges remaining exposed after installation; match color of exposed panel surfaces using coating recommended for this purpose by acoustical panel manufacturer.

3.04 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.05 ACOUSTICAL PANEL CEILING SCHEDULE

- A. Vinyl-Faced Mineral-Base Acoustical Panels: Provide panels complying with the following:
 - 1. Designation: AT-1.
 - 2. Product/Manufacturer: "Gypsum Lay-In Panels, No. 3270"; USG Interiors. (No substitutions)
 - 3. Color: White, Stipple Vinyl.
 - 4. Edge Detail: Square.
 - 5. Size: 24 by 48 inches.

- B. Suspension Systems for Acoustical Panel Ceiling AT-1: Provide acoustical panel ceiling suspension systems complying with the following:
1. Products/Manufacturer: Provide the following by USG Interiors:
 - a. Wide Face Suspension System: "Donn DXLA."
 2. Wide-Face Steel Suspension System:
 - a. Structural Classification: Intermediate-duty system.
 - b. Face Finish: Aluminum cap, painted white.

END OF SECTION 09511

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SECTION 09770

FRP PANELS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes fiberglass reinforced plastic panels (FRP).

1.02 SUBMITTALS

- A. Product Data: Manufacturer's product data for specified products.
- B. Samples: Two samples of each type of panel and each type of trim and fastener.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Package sheets on skids or pallets for shipment to project site.
- B. Storage: Store panels indoors in a dry place at the project site.
- C. Handling: Remove foreign matter from face of panel by use of a soft bristle brush, avoiding abrasive action.

1.04 PROJECT CONDITIONS

- A. Do not proceed with installation until building is enclosed, permanent heating and cooling equipment are in operation, and residual moisture from concrete or gypsum board work has dissipated to a level for the work to commence.
- B. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.
- C. Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Basis of Design: "Glasliner FRP"; Glasteel FRP.
- B. Other Acceptable Manufacturers:
 - 1. Kemlite / Crane Composites.
 - 2. Nudo Products.
- C. Wall Panel:
 - 1. Class III (C) interior finish, embossed surface, .090 minimum thickness.
 - 2. Color and Texture: Pebble textured. Color as indicated on Drawings.
- D. Division Bars, Corner Trim: Panel manufacturer's standard length extruded vinyl pieces; longest length possible to eliminate end joints. Divider strips and trim shall be glued.
- E. Fasteners: Not allowed. Glue all panels, divider strips and trim securely.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.
- B. Do not begin installation until substrate preparations to receive the FRP work are acceptable.

3.02 INSTALLATION

- A. General: Comply with manufacturer's printed instructions.
- B. Perform cutting and drilling with carbide tipped saw blades or drill bits, or cut with snips.
- C. Install panels with manufacturer's recommended gap for panel field and corner joints.

- D. For trowel type and application of adhesive, comply with adhesive manufacturer 's recommendations.

3.03 CLEANING

- A. Remove any adhesive or excessive sealant from panel face using solvent or cleaner recommended by panel manufacturer.

END OF SECTION 09770

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SECTION 09900

PAINTING

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes surface preparation and field painting of the following:
 - 1. Exposed exterior items and surfaces.
 - 2. Exposed interior items and surfaces.
 - 3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Related Sections:
 - 1. Section 05500 "Metal Fabrications" for shop priming ferrous metal.
 - 2. Section 07620 "Sheet Metal Flashing and Trim"
 - 3. Section 08110 "Steel Doors and Frames" for shop priming steel doors and frames.
 - 4. Divisions 15 and 16: Painting mechanical and electrical work is specified in Divisions 15 and 16, respectively.

1.02 SUBMITTALS

- A. Product Data: Minimum 30 days prior to beginning painting work, submit the following:
 - 1. Material List: An inclusive list of required coating materials. Identify each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 - 2. Manufacturer's Information: Provide the manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
- C. Samples: Identify each sample finish, formula, color name and number, and sheen name and gloss units. Submit to Owner's Representative for review.

1. Brush-Outs: Upon issue of final color schedule, prepare actual brush-outs for each paint and finish specified. Submit brush-outs in duplicate; minimum size 120 square inches. Apply products in specified number of coats for actual work to following substrates:
 - a. To Simulate Concrete: Concrete block painted one face.
- D. Colors: As indicated on the Drawings; if not indicated, as selected by Architect.

1.03 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a successful in-service performance.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
 1. Product name or title of material.
 2. Product description (generic classification or binder type).
 3. Manufacturer's stock number and date of manufacture.
 4. Contents by volume, for pigment and vehicle constituents.
 5. Thinning instructions.
 6. Application instructions.
 7. Color name and number.
 8. VOC content.
- B. Store materials not in use in tightly covered containers in one well ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 1. Unless specifically approved otherwise by Owner and Architect, provide a separate storage building for painting materials. Do not store painting materials in building without written approval.
 2. Keep storage area neat and orderly. Remove oily rags and waste daily. Keep one usable fire extinguisher in storage area.

1.05 PROJECT CONDITIONS

- A. Environmental Conditions: Ensure surface temperature or surrounding air temperature is above 40 deg F before applying finishes.
 1. Apply exterior water-based paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F.

2. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F.
 3. Do not apply paint in rain, fog or mist, when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
 4. Provide adequate continuous ventilation and sufficient heating facilities to maintain temperatures above 45 degrees F for 24 hours before, during, and 48 hours after application of finishes.
- B. Protection:
1. Adequately protect other surfaces from paint and damage. Repair damage resulting from inadequate and unsuitable protection.
 2. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray and droppings from damaging surfaces not being painted and in particular, surfaces within storage and preparation area.
 3. Place cotton waste, cloths, and material that may constitute fire hazard in closed metal containers and remove daily from site.
 4. Remove electrical plates, surface hardware, fittings, and fastenings prior to painting operations. These items are to be carefully stored, cleaned, and replaced on completion of work in each area. Do not use solvent that may remove permanent lacquer finish to clean hardware.
 5. Protect surfaces and materials not to be painted, including, but not limited to:
 - a. Prefinished work, i.e. anodized aluminum framing, thresholds, finish hardware (except where furnished primed), electrical lighting fixtures, items of mechanical and electrical equipment specified with factory finish, and architectural metals.
 - b. Ductwork, structural steel (except outside or exposed), and metal deck, and piping and conduit enclosed within chases.

1.06 MAINTENANCE MATERIALS

- A. Provide one (1) unopened container of all paints to the Owner. One gallon minimum container size.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Approved Manufacturer: Except as specified otherwise, brand name products of ICI Dulux and Devoe Coatings are named herein to establish quality and design standards for painting materials.

- B. Other Acceptable Manufacturers:
 - 1. Benjamin Moore and Co.
 - 2. Glidden/Devoe.
 - 3. Sherwin-Williams Co.
- C. Thinners, Gloss Modifiers, Texturing Materials: As manufactured, or recommended, by selected paint manufacturers.
- D. Refer to Drawings for additional requirements for paint products and systems.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Thoroughly examine surfaces scheduled to be painted prior to commencement of painting work. Report, in writing to Architect, all conditions that may affect proper application. Do not commence work until such defects have been corrected.
- B. Correct defects and deficiencies in surfaces that may adversely affect work of this Section.

3.02 SURFACE PREPARATION

- A. Clean and properly condition surfaces as required for painting. Application of paint to surface indicates acceptance of that surface and responsibility for satisfactory finish. Use moisture meter to verify dryness of surfaces for painting.
- B. Remove mildew by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow surface to dry completely.
- C. Remove oil, grease, rust, scale, dirt, and other foreign materials from surfaces to be painted. Smooth surfaces by grinding, sanding, filing, brushing, or other methods as required to provide smooth, uniform surfaces.
- D. Properly clean and dust surfaces before applying materials. Take particular precautions before applying final coats.
- E. Remove surface contamination from aluminum surfaces requiring paint finish by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

- F. Remove surface contamination and oils from galvanized surfaces and wash with solvent. Apply coat of etching type primer.
- G. Remove surface contamination and oils from zinc-coated surfaces and prepare for priming in compliance with metal manufacturer's recommendations.
- H. Remove grease, rust, scale, dirt, and dust from steel and iron surfaces. Where heaving coatings of scale are evident, remove by wire brushing, sandblasting or any other necessary method. Ensure steel surfaces are satisfactory before paint finishing.
- I. Clean unprimed steel surfaces by washing with solvent. Apply treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime surfaces to indicate defects, if any. Paint after defects have been remedied.
- J. Sand and scrape shop primed steel surfaces to remove loose primer and rust. Feather out edges to make touch up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
- K. Sand metal surfaces with 6/0 garnet paper between each coat. On shop-primed work and prior to starting field coatings, scrape and sand rusted, scaled, spalled and chipped areas; sand to bright metal and remove loose primer paint; recoat sanded areas with original or compatible primer.
- L. Remove dirt, loose mortar, scale, powder, and other foreign matter from concrete surfaces that are to be painted or to receive clear seal. Remove oil and grease with solution of trisodium phosphate, rinse well, and allow to thoroughly dry.
- M. Remove stains from concrete surfaces caused by weathering or corroding metals with solution of sodium metasilicate after being thoroughly wetted with water. Allow to thoroughly dry.
- N. Fill hairline cracks, small holes and imperfections on plaster surfaces with latex patching plaster. Smooth off to match adjacent surfaces. Wash and neutralize high alkali surfaces where they occur.

3.03 APPLICATIONS

- A. Apply each coat at proper consistency.
- B. Use white for primers, except metal shop primers. For each subsequent coat except final coat, use letdowns of final color, with different shade of each coat.

- C. Sand lightly between coats to achieve required finish.
- D. Do not apply finishes on surfaces that are not sufficiently dry.
- E. Allow each coat of finish to dry before following coat is applied, unless directed otherwise by manufacturer.
- F. Prime top and bottom edges of metal doors with enamel undercoat.

3.04 MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Review Divisions 15 and 16 for items of mechanical and electrical equipment to be painted. Contractor shall note that following items will require painting:
 - 1. Gas piping.
 - 2. RTU condensate drain piping.
 - 3. Fire sprinkler piping below 25 feet.
- B. Repaint exposed machinery and equipment as necessary to repair damaged finish. Do not paint over nameplates on machinery and equipment.
- C. Remove grilles, covers and access panels for mechanical and electrical systems from location and paint separately.
- D. Finish paint primed equipment to color selected.
- E. Paint, to limit of sight line, interior surfaces of air ducts and similar items that are visible through grilles and louvers, with one coat of flat black paint. Paint dampers exposed immediately behind louvers and grilles to match face panels.
- F. Paint exposed conduit and electrical equipment occurring in finished areas. Color and texture to match adjacent surfaces.

3.05 FIELD QUALITY CONTROL

- A. Paint surfaces, which require painted finish, are to be properly and completely finished with materials and in manner similar to other surfaces of similar type.
- B. Runs, sags, drips, thin spots, holidays, and other unworkmanlike results will not be accepted.
- C. Painting materials may be applied by brush, roller, or spray.

3.06 FINISHING FORMULAS

- A. Number of coats specified herein are minimum number to cover and finish decorated surfaces. If, after specified number of coats are applied, surfaces are not completely covered, apply additional coats as necessary at no additional cost to Owner. Allow each coat to dry thoroughly before applying succeeding coat.
- B. Exterior Surfaces:
 - 1. Galvanized Metals and Aluminum; Alkyd Enamel:
 - a. First Coat: No. 4120-1000 Devguard 4120 All Purpose Metal & Galvanized Primer; Devco Coatings Div., ICI Paints. Omit if shop primed.
 - b. Second and Third Coats: No. 4308-XXXX Devguard 4308 Alkyd Industrial Enamel; Devco Coatings Div., ICI Paints.
 - 2. Ferrous Metals; Alkyd Enamel:
 - a. First Coat: No. 4160-6120 Devguard 4160 Multi-Purpose Tank & Structural Primer, Gray; Devco Coatings Div., ICI Paints. Omit if shop primed.
 - b. Second and Third Coats: No. 4308-XXXX Devguard 4308 Alkyd Industrial Enamel; Devco Coatings Div., ICI Paints.
 - 3. Exterior Concrete: Painting is specified under Section 09910 "Exterior Special Coating."
 - 4. Concrete and Asphaltic Paving Traffic Marking:
 - a. First and Second Finish Coats: No. 63226 Glidden Traffic Paint; ICI Paints.
- C. Two-Component Polyurethane, Semi-Gloss Finish: 3 coats over shop primed steel. Provide for exposed exterior steel handrails and railings. Coating system manufactured by Tnemec Company, Inc. (Tnemec).
 - 1. First Coat: Two-component epoxy; 4.0-6.0 mils dry-film-thickness.
 - a. Tnemec: Series 66 Hi-Build Epoxoline.
 - 2. Second and Third Coats: Two-component aliphatic polyester polyurethane; 1.5-2.5 mils dry-film-thickness.
 - a. Tnemec: Series 1071 Endura-Shield.

- D. Interior Surfaces:
1. Ferrous Metals; Alkyd Semi-Gloss:
 - a. First Coat: No. 4160-6120 Devguard 4160 Multi-Purpose Tank & Structural Primer, Gray; Devoe Coatings Div., ICI Paints. Omit if shop primed.
 - b. Second and Third Coat: No. 1516-XXXX Ultra-Hide Alkyd Semi-Gloss Interior Wall & Trim Enamel; ICI Paints.
 2. Galvanized Metals and Aluminum; Alkyd Semi-Gloss:
 - a. First Coat: No. 4120-1000 Devguard 4120 All Purpose Metal & Galvanized Primer, White; Devoe Coatings Div., ICI Paints. Omit if shop primed.
 - b. Second and Third Coat: No. 1516-XXXX Ultra-Hide Alkyd Semi-Gloss Interior Wall & Trim Enamel; ICI Paints.
 3. Gypsum Board; Eggshell Latex:
 - a. First Coat: No. 3210 Aquacrylic Gripper; ICI Dulux.
 - b. Second and Third Coat: No. 1412-XXXX Ultra-Hide Latex Eggshell Interior Wall & Trim Enamel; ICI Paints.
 4. Gypsum Board; Epoxy Semi-Gloss:
 - a. First Coat: No. 3210-1200 Prep & Prime Gripper Multi-Purpose Interior/Exterior Water-Based Primer Sealer; ICI Paints.
 - b. Second and Third Coats: No. 4406-XXXX Tru-Glaze WB 4406 Waterborne Epoxy Semi-Gloss Coating; Devoe Coatings Div., ICI Paints.
 5. Concrete Masonry Units; Eggshell Latex:
 - a. Filler Coat: No. 4000-1000 Bloxfil 4000 Interior/Exterior Heavy Duty Acrylic Block Filler; Devoe Coatings Div., ICI Paints.
 - b. Second and Third Coats: 1412-XXXX Ultra-Hide Latex Eggshell Interior Wall & Trim Enamel; ICI Paints.
 6. Concrete Masonry Units; Epoxy Semi-Gloss:
 - a. Filler Coat: No. 4000-1000 Bloxfil 4000 Interior/Exterior Heavy Duty Acrylic Block Filler; Devoe Coatings Div., ICI Paints.
 - b. Second and Third Coats: No. 4406-XXXX Tru-Glaze WB 4406 Waterborne Epoxy Semi-Gloss Coating; Devoe Coatings Div., ICI Paints.
 7. Concrete; Eggshell Latex:
 - a. First Coat: No. 3210-1200 Prep & Prime Gripper Multi-Purpose Interior/Exterior Water-Based Primer Sealer; ICI Paints.
 - b. Second and Third Coats: 1412-XXXX Ultra-Hide Latex Eggshell Interior Wall & Trim Enamel; ICI Paints.

8. Concrete Floors, Epoxy Finish: Provide the following system by Floortech Inc.:
 - a. FT 101 Conditioner.
 - b. FT 310 Water Based Epoxy Primer.
 - c. FT 550 High Wear VOC finish coat.
9. Concrete Floors at Battery Racks: High performance epoxy coating utilizing a clear 100 percent solids epoxy.
 - a. First and Second Finish Coats: Eucopoxy Tufcoat DBS; Euclid Chemical Company. Nominal 20 mils total dry film thickness.

3.07 CLEANING AND INSPECTION

- A. As work progresses, and upon completion, remove paint where spilled, splashed, or splattered on other finished surfaces.
- B. Notify Owner upon completion of application of paint for purpose of inspection and acceptance.

END OF SECTION 09900

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SECTION 09910

EXTERIOR SPECIAL COATING

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes surface preparation and an exterior special coating for exterior concrete surfaces including, but not necessarily limited to, the following:
 - 1. Tilt-up precast concrete panels.
 - 2. Column bases.

1.02 SUBMITTALS

- A. Product Data: Indicate product description and instructions for preparation of surfaces to receive special coatings, rates and methods of applications and finishes to be expected in finished work.
- B. Color and Texture Samples: Submit two sets of color and texture samples from coating manufacturer proposed for use, for color selections by Owner.
- C. Brush-Outs:
 - 1. Prepare actual brush-outs for each color and texture.
 - 2. Submit to Owner brush-outs in duplicate; minimum size 120 square inches.
 - 3. Apply products in specified number of coats for actual work. Execute brush-outs on hardboard.
- D. Field Reports: Manufacturer to submit individual field quality control reports to the Architect, Owner, and Contractor.

1.03 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed exterior special coating applications similar in material and extent to that indicated for this Project with a successful in-service performance.

- B. Manufacturer's Technical Representative: Manufacturer to provide an authorized technical field representative to be present at the commencement of work and for periodic field inspection visits as specified in Article 3.02 "Application" of this Section.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Delivery:
 - 1. Deliver materials to the Project site in original containers with labels intact.
 - 2. Provide labels bearing manufacturer's name, coating type, color and recommended installation and reducing procedures.
- B. Storage and Handling:
 - 1. Maintain neat, clean conditions in storage area; remove rags and waste materials at end of each day's work.
 - 2. Close containers at end of day's Work. Leave no materials open.

1.05 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. Comply with manufacturer's product data for environmental conditions under which materials may be applied.
 - 2. Apply no materials in spaces where dust is being generated.
 - 3. Apply no materials on surfaces where temperature of substrate would result in excessive drying, which will cause streaks and discoloration.
- B. Protection: Cover finished work of other trades and surfaces not being coated concurrently and prefinished items.
- C. Safety Precautions:
 - 1. Provide temporary fire protection equipment in materials storage area.
 - 2. Prohibit smoking in storage area.

PART 2 - PRODUCTS

2.01 SPECIAL COATING

- A. Primary Coating: "Tex Cote XL-70 Textured Coating System/XL-70 Primer"; Textured Coatings of America, Inc. (TCA).
 - 1. Texture: Coarse to match existing, unless otherwise indicated.
 - 2. Color: White to match existing, unless otherwise indicated.

- B. Special Application Coating: "Tex Cote Reflect-Tec"; TCA. Primer as recommended by TCA for application substrate.
 - 1. Application: For field painted exterior "blue" painted accents and walls.
- C. Other Acceptable Product, Primary Coating: "Thorocoat"; BASF.
- D. Other Acceptable Product, Special Application Coating: An equivalent coating produced by BASF, subject to compliance with specified requirements.
- E. Application Equipment: As recommended by coating manufacturer.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Concrete: Allow concrete to cure a minimum of 28 days prior to coating application.
- B. All surfaces to be coated must be sound and clean. Surface contaminants such as dust, dirt, mildew, form oils and laitance must be thoroughly removed. Bond breaker residue must be thoroughly removed by water blasting. Painted surfaces exhibiting loose, flaking, or oxidized paint surfaces must be thoroughly removed by sand blasting, water blasting, electric sanding, or wire brushing as required by the manufacturer. All surfaces must be primed prior to coating substrates.
- C. Provide other preparations pursuant to coating manufacturer's written instructions. Manufacturer's authorized technical representative shall be present at the commencement of work to approve all surfaces to receive specified coating system prior to application of coating materials.

3.02 APPLICATION

- A. Apply prime coat at manufacturer's specified rate.
 - 1. Prior to application, the coating manufacturer's authorized technical representative shall perform and approve a field pull test to verify adhesion to substrates, in accordance with the coating manufacturer's recommendations, and in the presence of the Contractor.
- B. Apply finish coat after prime coat has properly cured and in compliance with manufacturer's product data, to achieve required dry film thickness.

1. The coating manufacturer's authorized technical representative shall perform and approve a field pull test to verify adhesion to application substrates, in accordance with the coating manufacturer's recommendations, and in the presence of the Contractor. Field pull tests to be performed at the 30 percent, 60 percent, 90 percent and 100 percent completion stages.
 2. The coating manufacturer's authorized technical representative shall verify that the required dry film thickness for the coating system has been achieved. Measurements for dry film thickness shall be performed during the same field visits noted above for field pull tests.
 3. The Contractor will be required to perform corrective measures, as determined by the manufacturer's authorized technical representative, to ensure proper coating adhesion to substrates and an acceptable dry film thickness for the coating system.
- C. Apply coating only when moisture content of surfaces is within manufacturer's published limits.
- D. Primary Coating: Apply finish coat material using spraying equipment only; minimum 20 mils dry film thickness.
- E. Special Application Coating: Provide two finish coats at manufacturer's recommended rate of application per coat.
- F. Apply materials at rate not exceeding that recommended by manufacturer's product data for surface being coated, less ten percent for losses.
- G. Comply with manufacturer's product data for drying time between coats.
- H. Finish coats shall be smooth, free of brush marks, streaks, laps, or pile-up of coating, skipped or missed areas.
- I. Make edges of coating adjoining other materials or colors clean and sharp without overlapping.
- J. Final Inspection: The manufacturer's authorized technical representative to perform a two-stage final inspection. The initial final inspection shall be performed in conjunction with development of the Contractor's corrective work punchlist. The second final inspection will be required to verify all corrective work necessary for integrity of coating system bonding to application substrates and an acceptable dry film thickness for the coating system.

3.03 CLEANING AND PROTECTION

- A. Clean up work and protect adjacent work not to be coated pursuant to coating manufacturer's written instructions. Provide suitable protections against overspray onto concrete slabs and other substrates; if overspray does occur, remove immediately.
- B. Protect work to minimize staining from adjacent soils. Clean dirt and stains from concrete panels.

END OF SECTION 09910

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SECTION 10156

SOLID PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes toilet compartments and screens as follows:
 - 1. Type: Solid plastic, polymer resin.
 - 2. Compartment Style: Overhead braced and anchored.
 - 3. Screen Style: Wall hung.
- B. Related Sections:
 - 1. Section 10801 "Toilet Accessories."

1.02 SUBMITTALS

- A. Product Data: For each type and style of toilet compartment and screen specified. Include details of construction relative to materials, fabrication, and installation. Include details of anchors, hardware, and fastenings.
- B. Shop Drawings: For fabrication and installation of toilet compartment and screen assemblies. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show locations of reinforcement and cutouts for compartment-mounted toilet accessories.

1.03 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
 - 1. Bobrick Washroom Equipment, Inc.
 - 2. Crane Plumbing; Sanymetal.
 - 3. Global Steel Products Corp.
 - 4. Santana Products, Inc.

2.02 MATERIALS

- A. General: Provide materials that have been selected for surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are unacceptable.
- B. Solid Plastic, Polymer Resin: High density polyethylene (HDPE) with homogenous color throughout. Provide material not less than 1 inch thick with seamless construction and eased edges in color and pattern as follows:
 - 1. Color and Pattern: As indicated on Drawings.
- C. Pilaster Shoes and Sleeves (Caps): Provide manufacturer's heavy duty plastic pilaster shoes and sleeves.
- D. Full Height (Continuous) Brackets: Manufacturer's heavy duty design for attaching panels and screens to walls and pilasters of the following material:
 - 1. Material: Clear anodized aluminum.
- E. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories of the following material:
 - 1. Material: Stainless steel.

- F. Overhead Bracing: Manufacturer's heavy duty continuous, extruded aluminum strip in manufacturer's standard finish.
- G. Anchorages and Fasteners: Manufacturer's heavy duty exposed fasteners of stainless steel, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.03 FABRICATION

- A. General: Provide standard doors, panels, screens, and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive partition-mounted hardware, accessories, and grab bars, as indicated.
- B. Solid Plastic, Polymer Resin Compartments and Screens: Provide aluminum heat-sink strips at exposed bottom edges of HDPE units to prevent burning.
- C. Overhead-Braced-and-Floor-Anchored Compartments: Provide manufacturer's heavy duty corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.
 - 1. Solid Plastic Polymer Resin Units: Provide manufacturer's standard 4 inch high, overhead cross bracing.
- D. Wall Hung Screens: Provide units in sizes indicated of same construction and finish as compartment panels, unless otherwise indicated.
 - 1. Provide metal-faced screens with integral full height flanges for attachment to wall.
- E. Doors: Unless otherwise indicated, provide 24 inch wide in-swinging doors for standard toilet compartments and 36 inch wide out-swinging doors with a minimum 32 inch wide clear opening for compartments indicated to be handicapped accessible.

1. Hinges: Manufacturer's heavy duty self-closing type that can be adjusted to hold door open at any angle up to 90 degrees.
2. Latch and Keeper: Manufacturer's heavy duty surface-mounted latch unit with combination rubber-faced door strike and keeper designed for emergency access. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be handicapped accessible.
3. Coat Hook: Manufacturer's heavy duty combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
4. Door Bumper: Manufacturer's heavy duty rubber-tipped bumpers at out-swinging doors or entrance screen doors.
5. Door Pull: Manufacturer's heavy duty unit that complies with accessibility requirements of authorities having jurisdiction at out-swinging doors. Provide units on both sides of doors at compartments indicated to be handicapped accessible.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, plumb, and level. Provide clearances of not more than 1/2 inch between pilasters and panels and not more than 1 inch between panels and walls. Secure units in position with manufacturer's recommended anchoring devices.
 1. Secure panels to walls and panels with continuous brackets.
- B. Overhead-Braced-and-Floor-Anchored Compartments: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less than 2 fasteners. Hang doors and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Screens: Attach with anchoring devices according to manufacturer's written instructions and to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.02 ADJUSTING AND CLEANING

- A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and swing doors in entrance screens to return to approximately 10 degrees from closed position.
- B. Provide final protection and maintain conditions that ensure toilet compartments and screens are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 10156

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SECTION 10520

FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes:
 - 1. Portable fire extinguishers, including surface-mounted units.
 - 2. Accessories, including brackets for wall-mounted applications.

1.02 QUALITY ASSURANCE

- A. Comply with NFPA 10 - Portable Fire Extinguishers.

1.03 SUBMITTALS

- A. Product Data: Include physical dimensions, operational features, color and finish, wall mounting brackets with mounted measurements, anchorage details, rough-in measurements, location details, and manufacturer's installation instructions.
- B. Operational and Maintenance Data: In compliance with Section 01770 "Contract Closeout" and as specified herein.
 - 1. Include testing, refill or recharge schedules, procedures, and recertification requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
 - 1. Sheet: ASTM B 209.
 - 2. Extruded Shapes: ASTM B 221.

2.02 FIRE EXTINGUISHERS

- A. Basis of Design Manufacturer: J. L. Industries, Inc. Other acceptable manufacturers:
 - 1. Potter-Roemer.
 - 2. Larsen's Manufacturing Company.
- B. Fire Extinguishers, Warehouse: Cosmic 10E (4A-80BC). Provide Model No. MB846A for wall mounted bracket installations.
- C. Fire Extinguishers, Non-Warehouse Spaces: Cosmic 5E (3A-40BC). Provide Model No. MB846C for wall mounted bracket installations.
- D. Wrap red 2 inch wide reflective tape around columns at 20 feet above finished floor to identify fire extinguisher locations.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Fire Extinguishers: Securely install wall hung extinguishers on wall mounting brackets mounted 4'-6" from finished floor to top of extinguisher assembly. Coordinate all locations with Owner prior to installation.

3.02 ADJUSTING AND CLEANING

- A. Touch up marred finishes.

END OF SECTION 10520

SECTION 10538

METAL CANOPIES

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes prefinished metal dock canopies, in locations as indicated on Drawings.

1.02 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
 - 1. AAMA 2605: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- B. ASTM International (ASTM):
 - 1. ASTM A 653: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.03 QUALITY ASSURANCE

- A. Code Compliance: Total installation for metal canopies must comply with the requirements of the North Carolina Building Code, current edition in force.
- B. Design Criteria:
 - 1. Thermal Movement: Complete canopy systems capable of withstanding expansion and contraction of components caused by temperature range from -10 deg F to +150 deg F without buckling, excess stress on framing structure or adjacent structures, anchors, or fasteners.
 - 2. Structural Performance:
 - a. Complete canopy system shall withstand wind loading based on a 110 mph wind speed design and uplift requirements as required by the North Carolina Building Code.
 - b. Maximum Allowable Deflection of Frame: L/240.
 - 3. Anchors: Capable of transmitting design loads and thermal expansion loads assigned to single anchor; with safety factor of 2.5.

1.04 SUBMITTALS

- A. Product Data: Include full system and material description, finish, and installation instructions.
- B. Shop Drawings: Show canopy in elevation and plan with sections and details at full scale. Include metal thicknesses, joining details, field connections, anchorage, provisions for expansion, fastening and sealing methods and metal finishes. Indicate relationships with adjacent and interfacing work.
 - 1. Include wind load and related structural analysis data sealed and signed by the qualified professional engineer, licensed in the State of North Carolina, responsible for their preparation.
- C. Samples:
 - 1. Submit minimum 12 inch length of typical beam, fascia, and decking components.
 - 2. Submit minimum 6 inch by 6 inch samples, finished as specified, indicating range of finish color and texture to be expected in finished Work.
- D. Maintenance Data: Include instructions for general maintenance and repair of surfaces and finishes.
- E. Maintenance Materials: Provide one complete metal canopy unit as extra materials for repair.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver canopy units to site until time for installation.
- B. Erect canopy units following completion of adjacent construction.
- C. Protect materials from physical damage, staining, or other harm to material or finish.

1.06 WARRANTIES

- A. Installer Warranty: Provide a written warranty stipulating the completed canopy work to be free from faults and defects in materials and workmanship. The Warranty shall include a requirement to provide prompt repair at no additional cost to Owner.
 - 1. Warranty Period: 2 years from date of Certificate of Occupancy.

- B. Finish Warranty: Provide a written warranty for all finishes against blistering, peeling, or any other separation of coating from substrate, and against color loss of more than five NBS units.
 - 1. Warranty Period: 20 years from date of Certificate of Occupancy.

PART 2 - PRODUCTS

2.01 MANUFACTURER AND MATERIALS

- A. Canopy Manufacturer: One of the following; no substitutions are permissible:
 - 1. AEP/SPAN.
 - 2. Childers Carports & Structures, Inc.
 - 3. Mapes Industries, Inc.
 - 4. Royal Aluminum.
 - 5. Shade Systems.
- B. Components: As follows:
 - 1. Fascia/Gutter: 28 gage "Galvalume" complying with ASTM A 653. Roll formed 8-inch-deep fascia/gutter with preformed corners. Canopy profile as indicated on Drawings.
 - 2. Soffit Panels: 28 gage "Galvalume," roll formed, "W" panels. Comply with ASTM A 653.
 - 3. Trim and Support Components: To match soffit panel material and gage.
 - 4. Fasteners: Material and finish on exposed portions to match canopy, unless another noncorrosive metal material is recommended by manufacturer.
 - 5. Sealants: As recommended by soffit panel manufacturer.
 - 6. Finishes:
 - a. Soffit Panels and Trim: PPG Industries' "Duranar" two-coat shop-applied, baked-on premium fluoropolymer coating system based on Arkema's "Kynar 500" resin (polyvinylidene fluoride), formulated by licensed manufacturer and applied by manufacturer's approved applicator to meet requirements of AAMA 2605.
 - b. Gutter and Soffit Panels: Baked polyester finish, roller coated two sides.
 - c. Color: Match Benjamin Moore's #336 Yellow.
- C. Scuppers: Provide drainage of gutters through scuppers in the bottom of outboard line of gutter. Spacing as indicated on Drawings.

2.02 FABRICATION

- A. Form work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to radius of approximately 1/32 inch. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing Work.
- B. Form profiles without waves or buckling in metal surfaces.
- C. Provide anchorages for attachment to supporting substrates as indicated on approved shop drawings. Space anchoring devices as indicated and as required to comply with North Carolina Building Code.
- D. Fabricate all flashings, closures, and similar components as indicated on Drawings.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Verify location and alignment of preset anchors. Report deviations and proposed method for correction to Architect prior to commencement of Work.
- B. Provide anchorage devices and fasteners for securing items to in-place construction, including threaded fasteners for concrete inserts. Anchor bolts and erection bolts of types and sizes indicated on approved shop drawings.

3.02 INSTALLATION

- A. Set Work in location, alignment, and elevation, plumb and level within specified tolerances, true and free of rack; measured from established lines and levels. Install Work in compliance with approved shop drawings.
- B. Protect components from contact with dissimilar materials by separating with concealed neoprene gaskets or bituminous coating. Protect finishes from damage or scratching during installation.
- C. Provide connections as indicated on approved shop drawings. Join dissimilar metals by incorporating galvanic separators in bolted connections.

3.03 CLEANING

- A. Cleaning: Maintain canopy assembly in acceptable clean condition during construction period. Immediately remove stains or materials having adverse effect on materials and finishes. Remove excess sealant compounds.
- B. Final Cleaning: Just prior to Date of Certificate of Occupancy, clean entire canopy assembly, using pretested detergent and water. Flush with clean water. Repair or replace Work which cannot be cleaned or which has been damaged during construction operations.

END OF SECTION 10538

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SECTION 10801

TOILET ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes toilet accessories as scheduled.

1.02 REFERENCES

- A. ASTM International (ASTM):
1. ASTM A 153: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 2. ASTM A 653: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 3. ASTM A 666: Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 4. ASTM A 1008: Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 5. ASTM C 1053: Specification for Silvered Flat Glass Mirrors.
 6. ASTM F 446: Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area.

1.03 SUBMITTALS

- A. Product data for each toilet accessory item specified, including details of construction relative to materials, dimensions, gages, profiles, method of mounting, specified options, and finishes.

1.04 QUALITY ASSURANCE

- A. Inserts and Anchorages: Furnish inserts and anchoring devices that must be set in concrete or built into masonry. Coordinate delivery with other work to avoid delay.

1.05 PROJECT CONDITIONS

- A. Coordination: Coordinate accessory locations, installation, and sequencing with other work to avoid interference and to assure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

1.06 WARRANTY

- A. Special Project Warranty: Submit a written warranty executed by mirror manufacturer, agreeing to replace any mirrors that develop visible silver spoilage defects within warranty period.
 - 1. Warranty Period: 15 years from date of Certificate of Occupancy.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Basis of Design: Provide toilet accessories manufactured by Bobrick Washroom Equipment, Inc.; **NO SUBSTITUTIONS**. Refer to Drawings for model numbers.

2.02 MATERIALS, GENERAL

- A. Stainless Steel: ASTM A 666, Type 304, 0.0312 inch minimum nominal thickness, unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008, Designation CS (cold rolled, commercial steel), 0.0359 inch minimum nominal thickness.
- C. Galvanized Steel Sheet: ASTM A 653, with G60 hot-dip zinc coating.
- D. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.
- E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper- and-theft resistant where exposed, and of galvanized steel where concealed.
- F. Mirror Glass: ASTM C 1053, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- G. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.

- H. Fasteners: Screws, bolts, and other devices of same material as accessory unit or of galvanized steel where concealed.

2.03 GRAB BARS

- A. Stainless Steel Type: Provide grab bars with wall thickness not less than .50 inch (18 gage) and as follows:
 - 1. Mounting: Concealed, manufacturer's standard flanges and anchorages.
 - 2. Clearance: 1-1/2 inch clearance between wall surface and inside face of bar.
 - 3. Gripping Surfaces: Smooth, satin finish.
 - 4. Heavy-Duty Size: Outside diameter of 1-1/2 inches.

2.04 MIRROR UNITS

- A. Stainless Steel Framed Mirror Units: Fabricate frame with angle shapes not less than 0.05 inch (18 gage), with square corners mitered, welded, and ground smooth. Provide in No. 4 satin polished finish.
- B. Fixed-Tilt, Stainless Steel Framed Mirror Units: Fabricate frame of not less than .040 inch (20 gage) stainless steel, with all joints mitered, welded, and ground smooth. Construct frame so that taper is not less than 3 inches from top to bottom.

2.05 FABRICATION

- A. General: No names or labels are permitted on exposed faces of toilet and bath accessory units. On either interior surface not exposed to view or on back surface, provide identification of each accessory item by either a printed, waterproof label or a stamped nameplate indicating manufacturer's name and product model number.
- B. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.

- C. Framed Mirror Units, General: Fabricate frames for glass mirror units to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system that will permit rigid, tamperproof glass installation and prevent accumulation of moisture, as follows:
 - 1. Provide galvanized steel backing sheet, not less than .034 inch (22 gage) and full mirror size, with non-absorptive filler material. Corrugated cardboard is not an acceptable filler material.
- D. Mirror Unit Hangers: Provide system of mounting mirror units that will permit rigid, tamperproof, and theftproof installation, as follows:
 - 1. One-piece galvanized steel wall hanger device with spring action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

PART 3 - EXECUTION

1.01 INSTALLATION

- A. Install toilet accessory units according to manufacturers' instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated.
- B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.
- C. Install grab bars to withstand a downward load of at least 250 lbf, complying with ASTM F 446.

1.02 ADJUSTING AND CLEANING

- A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.
- B. Clean and polish all exposed surfaces strictly according to manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION 10801

SECTION 10905
MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Types of miscellaneous specialties required include:
 - 1. Steel safety barriers.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and installation instructions for all items specified herein.
- B. Shop Drawings: Submit shop drawings showing complete fabrication and installation details for all items specified herein.
- C. Samples: As may be requested.

PART 2 - PRODUCTS

2.01 STEEL SAFETY BARRIERS

- A. Description: Heavy duty fabricated steel barrier assembly to prevent forklifts and similar warehouse vehicles from damaging building elements. Assembly can withstand a 10,000 lb. vehicle traveling at speeds up to 4 mph.
- B. Product/Manufacturer: "Guardrite Heavy Duty"; Rite-Hite Corporation.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install all miscellaneous specialties in accordance with applicable standards, manufacturer's published instructions and current recommendations, and approved shop drawings.

END OF SECTION 10905

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SECTION 11160
LOADING DOCK EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Dock bumpers.
 - 2. Recessed dock levelers.
- B. Related Sections:
 - 1. Section 03300 "Cast-in-Place Concrete" for concrete work for recessed dock and truck levelers.
 - 2. Section 05500 "Metal Fabrications" for curb angles at edge of loading dock and around edge of recessed dock-leveler pit, and for platform edge channels.
 - 3. Section 08361 "Sectional Overhead Doors" for overhead doors electrically interlocked to levelers.
 - 4. Division 16 Sections for electrical wiring and connections.

1.02 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI Z535.1: Safety Color Code.
- B. Material Handling Industry of America (MH):
 - 1. MH 30.1: Safety, Performance and Testing of Dock Leveling Devices (ANSI).
- C. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA ICS-6: Industrial Control and Systems: Enclosures.

1.03 DEFINITIONS

- A. Operating Range: Maximum amount of travel above and below the dock level.
- B. Working Range: Recommended amount of travel above and below the dock level for which loading and unloading operations can take place.

1.04 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, accessories, details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- B. Shop Drawings: Show details of fabrication and installation. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Provide templates for anchors and bolts anchored to permanent construction.
 - 2. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.
- C. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent professional engineer, indicated compliance of dock levelers with requirements of MH 30.1 for determining rated capacity, based on comprehensive testing within the last two years of current products.
- D. Maintenance Data: Include name, address, and telephone number of manufacturer's nearest authorized service representative.
- E. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who is an authorized representative of loading dock equipment manufacturer for both installation and maintenance of type of equipment required for this Project.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of North Carolina and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of loading dock equipment that are similar to those indicated for this Project in material, design, and extent.
- C. Dock Leveler Standard: Comply with ANSI/MH 30.1.

1.06 COORDINATION

- A. Recessed Dock Levelers: Coordinate size and location of pits to ensure proper clearances and operation of equipment. Concrete, reinforcement, and formwork requirements are specified in Section 03300 "Cast-in-Place Concrete."
- B. Coordinate delivery of built-in anchoring devices to Project site to avoid delaying progress.

1.07 WARRANTY

- A. Dock Leveler Warranty: Submit a written warranty, executed by manufacturer, agreeing to repair or replace loading dock equipment components that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:
 - 1. Structural failures, including cracked or broken structural support members and load-bearing welds.
 - 2. Deck plate failures, including cracked plate or permanent deformation in excess of 1/4 inch between deck supports.
 - 3. Faulty operation of operators, control system, or hardware.
- B. Warranty Period: Two years from date of Substantial Completion.
 - 1. Warranty shall be for unlimited usage of the leveler for the specified rated capacity over the term of the warranty.

1.08 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of dock equipment Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper equipment operation at rated speed and capacity. Provide parts and supplies as used in the manufacturer and installation of original equipment.
 - 1. Perform maintenance, including emergency callback service, during normal working hours.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following for each of the categories listed; NO substitutions are permissible.

- B. Air-Bag Operated Recessed Dock Levelers:
 - 1. Kelley Atlantic Ltd.
- C. Dock Bumpers to be provided as part of the dock leveler manufacture's assembly.
 - 1. Basis of Design: "Model B Series"; Durable Corporation.
 - 2. Size: 10" by 12" face dimension. Match existing facility.

2.02 DOCK BUMPERS

- A. Laminated Tread Bumpers: Provide units of size indicated, fabricated from multiple plies cut from fabric-reinforced rubber tires to a uniform thickness of 4-1/2". Laminate plies under pressure on 3/4" diameter, steel supporting rods that are welded and bolted to 1/4" thick, structural steel angle closures with predrilled anchor holes. Size angles to provide not less than 1" of tread plies extending beyond the face of the closure angles.
- B. Anchorage Devices: Provide anchor bolts, nuts, washers, bolts, sleeves, cast-in-plate, and other anchorage devices as required to fasten bumpers securely in place and suit installation type indicated. Hot-dip galvanize anchorage components.
 - 1. Ensure bumpers are preassembled to dock leveler frame or install per manufacturer's installation instructions.

2.03 RECESSED DOCK LEVELERS

- A. General: Provide recessed dock levelers of the type, function, operation, capacity, size, and construction indicated, complete with controls, safety devices, and accessories required.
- B. Type: Recessed, hinged-lip-type dock levelers designed for permanent installation in concrete pits, preformed in edge of loading platform.
- C. Function: Dock levelers shall compensate for differences in height between truck bed and loading platform in the following manner:
 - 1. Vertical Travel: Minimum working range shall be 12 inches above and 12 inches below the adjoining platform level. Provide an operating range above platform level of sufficient height to enable lip to extend and clear truck bed before contact.
 - 2. Automatic Vertical Compensation: Floating travel of ramp with lip extended and resting on truck bed to compensate automatically for upward or downward movement of truck bed during loading and unloading.
 - 3. Automatic Lateral Compensation: Tilting of ramp with lip extended

and resting on truck bed shall compensate automatically for canted truck beds of up to 4 inches over width of ramp.

4. Lip Operation: Manufacturer's standard mechanism that automatically extends and supports hinged lip on ramp edge with lip resting on truck bed over dock leveler's working range, allows lip to yield under impact of incoming truck, and automatically retracts lip when truck departs. Length of lip extension not less than 16 inches from ramp edge and not less than 12 inches in front of dock bumpers.

- D. Air-Bag Operating System: Provide electric high-volume, low-pressure lifting of ramp, controlled from a remotely located push-button station. Equip leveler with a packaged unit including a PVC-coated polyester lifting bag and two-stage, single-speed electric fan of proper size, type, and operation for capacity of leveler indicated. Include dock-leveler supports controlled by release chain for lowering ramp below platform level without extending lip.
 - 1. Electrical Requirements: Coordinate wiring requirements and current characteristics with building electrical system. See Division 16 Sections.
 - 2. Remote-Control Station: Provide a single-button station of the constant-pressure type, enclosed in a shielded NEMA ICS 6, Type 4 box. Raise ramp by holding the button depressed, and lower ramp at a controlled rate by releasing button.
- E. Rated Capacity: Provide dock levelers capable of supporting a total gross load indicated below without permanent deflection or distortion, as determined by actual tests complying with requirements of ANSI/MH30.1 for rated capacity.
 - 1. Total Load: Not less than 30,000 lb.
- F. Safety Devices: Provide manufacturer's standard and optional safety devices as follows:
 - 1. Toe Guards: Protect open sides of rising ramp over entire upper operating range with metal toe guards mounted flush with ramp edges and projecting below ramp.
 - 2. Cross-Traffic Support: Provide manufacturer's standard method of supporting ramp at platform level in stored position with lip retracted. Provide a means to release supports to allow ramp to descent below platform.
 - 3. Maintenance Strut: Provide an integral strut to positively support ramp in the up position during maintenance of dock leveler.
 - 4. Leveler to Overhead Door Interlock: Provide control interlock designed so that leveler will not operate while door is in closed position.
- G. Construction: Fabricate dock leveler frame from structural and formed steel shapes. Fabricate platform, including hinged lip, from non-skid steel plate. Fabricate entire assembly to withstand deformation during both operating and stored phases of service. Chamfer lip edge to minimize obstructing wheels of material-handling vehicles. Include two dock bumpers attached to frame.
 - 1. Clean Pit Frame: Provide leveler framing designed to support leveler at sides of pit, with no side-to-side supports at front and back of pit floor.
 - 2. Curb Angles: Provide 3-by-3-by-1/4 inch galvanized steel curb

angles for edge of recessed leveler pit, with 1/2-inch diameter by 6 inch long concrete anchors welded to angle at 6 inches o.c.

- H. Finish and Color: Manufacturer's standard paint applied to factory-assembled and factory-tested dock levelers before shipping. Paint toe guards yellow to comply with ANSI Z535.1, and paint remainder of surfaces in manufacturer's standard color.
 - 1. Field Finish Painting: To match Benjamin Moore's "#1602 – Dark Gray."
- I. Accessories: Equip units with manufacturer's standard accessories as follows:
 - 1. Night Locks: Provide manufacturer's standard means to prevent extending lip and lowering ramp when overhead doors are locked.
 - 2. Side and rear weatherseals.
- J. Basis of Design: "Model FX6x8" Kelley Atlantic Ltd.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of loading dock equipment.
- B. Examine roughing-in for electrical systems for dock equipment to verify actual locations of connections before installation.
- C. Examine walls and floors of pits for suitable conditions where recessed dock equipment is to be installed. Pits shall be plumb and square, and properly sloped for drainage from back to front of dock.
- D. Proceed with installation of loading dock equipment only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. General: Coordinate installation of loading dock equipment indicated to be attached to or recessed into concrete or masonry, and furnish anchoring devices with templates, diagrams, and instructions for their installation.
- B. Clean recessed pits of debris.

3.03 INSTALLATION, GENERAL

- A. General: Comply with manufacturer's detailed written instructions for installing loading dock equipment.
 - 1. Install equipment, air bag, fan motor, control stations and wiring, safety devices, and accessories as required for a complete installation.
- B. Rough-in electrical connections according to requirements in Division 16.

3.04 DOCK LEVELER INSTALLATION

- A. Set curb angles in concrete with tops flush with platform. Fit exposed connections together to form hairline joints.
- B. Attach leveler securely to loading platform construction according to manufacturer's written instructions, flush with adjacent dock surfaces and square to recessed pit.
- C. Recessed Dock Levelers: Coordinate forming recessed pit for dock levelers to ensure that recess is adequate to accommodate leveler in proper relationship to loading platform.

3.05 ADJUSTING

- A. Adjust loading dock equipment for safe, efficient operation.
- B. Test dock levelers and lifts for vertical travel within operating range indicated.

3.06 CLEANING AND PROTECTING

- A. Restore marred, abraded surfaces to their original condition.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure loading dock equipment is without damage or deterioration at the time of Substantial Completion.

3.10 DEMONSTRATION

- A. Start-Up Services: Engage a factory-authorized service representative to perform start-up and to train Owner's maintenance personnel as specified below:
 - 1. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
 - 2. Train Owner's maintenance personnel on procedures and schedules

related to start-up and shutdown, troubleshooting, servicing, and preventive maintenance.

3. Review data in operating and maintenance manuals.
4. Provide adjustment and servicing of levelers after nine months of operation.

- B. Laminate and mount operating instructions on wall adjacent to unit.

END OF SECTION 11160

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SECTION 13851

FIRE ALARM SYSTEM

This specification covers the requirements for design, installation, and testing of new devices to be connected to existing fire alarm system that will monitor alarm, supervisory and trouble conditions relative to the fire sprinkler systems and water supply equipment as applicable. The system will be monitored by a UL listed Central Station via a local Digital Alarm Communicator Transmitter.

PART 1 GENERAL

1.01. SECTION INCLUDES

- A. The scope of work includes implementation of the design of the system in accordance with this specification and applicable codes; preparation of appropriate drawings and calculations; submittal of drawings, calculations, equipment data sheets, and bill of materials; completion of final operational tests.
- B. The scope of work includes all necessary programming of the FACP and DACT by the Contractor. All revisions to these programs, which are required by the approval authorities up to the point of final acceptance of the complete system by all approval authorities, are to be carried out by the Contractor at no additional expense to the Owner.
- C. The scope of work also includes provision of all necessary technical personnel support by the Contractor for completion of interim system inspections and tests as well as thorough acceptance tests by the various approval authorities.
- D. The Contractor is responsible for coordination of the installation of all system related equipment with other subcontractors. Where conflicts exist, the Contractor is responsible for making the General Contractor aware of each situation so that the appropriate action may be determined.
- E. The Contractor is responsible for identifying all permitting requirements and jurisdiction specific requirements related to the system installation and shall assure that all local requirements have been met with respect to required equipment, specific system functional requirements, etc.
- F. Rooms To Go would like some partial, audible coverage in the warehouse area, horns at each riser location and each interior pod area (i.e. office/rest rooms/break/shop). It shall be the contractors responsibility to consult with the authority having jurisdiction as to whether this is acceptable.

- G. This project will require coordination with the General Contractor, Architect and Engineer as well as the local Authority Having Jurisdiction for any required interface with the systems provided in the retail showroom and outlet as well as the pump house.

1.02. RELATED SECTIONS

- A. Section 13930 Wet-Pipe Fire Sprinkler Systems
- B. The conditions of the Contract, including the General Conditions and Supplementary Conditions, and Division 1 - General Requirements, apply to work covered by this Section.
- C. Comply with Division 2, 13, 15, and 16 Sections, as applicable. Refer to other Divisions for coordination of work.

1.03. DEFINITIONS

- A. Equipment and materials shall be approved for their designed use and performance. The term "approved" shall mean Factory Mutual (FM) approved and/or Underwriters Laboratories (UL) listed and acceptable to the approval authorities.
- B. Approval authorities shall include Rooms To Go (Owner), authorized representative Telgian Corporation (Engineer), the General Contractor, and the local fire/code official(s), where applicable, (Authorities Having Jurisdiction).
- C. The term "Contractor" as used within this specification refers to the electrical and/or fire alarm system subcontractor(s).

1.04. EXCLUSIONS

- A. The following items are outside the scope of the Contractor:
- B. Provision of sprinkler water flow and valve tamper switches.
- C. All wiring associated with the telephone line connections to the Digital Alarm Communicator Transmitter (DACT).

1.05. SYSTEM DESCRIPTION

- A. Design Requirements
 - 1. All panels and peripheral devices shall be the standard product of a single manufacturer matching existing and shall display the manufacturer's name on each component. All components of the system shall be UL-listed or FM- approved and compatibility of all system components shall be verified.

2. Selection of cable types and wire with respect to conductor size, shielding requirements, and separation between circuits shall be in full compliance with the requirements of the manufacturer of the FACP and DACT, without exception. All circuit wire/cable shall be specifically listed for use with fire alarm systems.
3. To accommodate and facilitate job site changes, all circuits shall be individually configurable on-site.
4. . In no case shall circuit and/or module loading exceed eighty (80) percent of the design capacity as specified by the manufacturer.
5. A smoke detector and manual fire alarm box shall be installed at the FACP as indicated on the drawings.

B. Performance Requirements

1. Activation of a water flow switch or manual fire alarm box shall annunciate an audible and visual ALARM signal at the FACP, activate horn/strobe devices and transmit an ALARM signal through the DACT to the Central Station monitoring company.
2. Activation of a valve tamper supervisory switch shall annunciate a SUPERVISORY signal at the FACP and transmit a SUPERVISORY signal through the DACT to the Central Station monitoring company.
3. Circuit faults on protective signaling system circuits or failure of protective signaling system primary power shall annunciate a TROUBLE signal at the FACP and transmit a TROUBLE signal through the DACT to the Central Station monitoring company.
4. A single addressable interface module shall not monitor more than one control valve supervisory switch.

C. Power Supply Arrangement

1. Power to the FACP, Boosters and DACT shall be supplied from a dedicated A.C. power circuit that serves no other loads.
2. The circuit shall be equipped with a separate breaker that is properly sized and identified at the circuit breaker and FACP per NFPA 70 and NFPA 72.
3. The circuit breaker shall be locked to prevent unauthorized operation.
4. The circuit breaker shall be marked red.

1.06. SUBMITTALS

- A. The Contractor shall prepare a SHOP SUBMITTAL PACKAGE covering the complete system. The Shop Submittal package shall be submitted to the

approval authorities for review and approval. The Shop Submittal package should be approved prior to ordering materials or starting construction. The complete submittal shall conform to all requirements of this section.

- B. The Contractor shall submit the SHOP SUBMITTAL PACKAGE to each approval authority individually and simultaneously including the following:
 - 1. Engineer.
 - 2. General Contractor.
 - 3. Local Authority Having Jurisdiction.
- C. The SHOP SUBMITTAL PACKAGE shall include the following information:
 - 1. Complete system expansion shop drawings, drawn to scale and showing all system components, including FACP, DACT, initiating devices, addressable modules, etc. Drawings shall also show point-to-point wiring to all devices. Elementary wiring schematics shall also be provided. Drawings shall be 30-inch x 42-inch, and the drawing scale shall not be smaller than a scale of 3/16 in. = 1 ft.
 - 2. Drawings shall indicate wire counts, type and size of wire or cable used, and the size and type of all conduit and their locations throughout. The location of all junction boxes shall be shown. A legend and color-coding scheme shall be clearly indicated on the drawing set. Comply with NEC for tables indicating cross-sectional area of all wire and area.
 - 3. All drawing submittals shall be submitted on the same size sheets. The drawings shall be sequentially numbered throughout the entire set.
 - 4. At the time of completion of the submittal package, the Contractor shall independently perform a quality assurance review of the entire submittal package internally to assure completeness and conformance with the specification and design drawings.
 - 5. Complete battery backup calculations shall be provided in conformance with NFPA 72 for the FACP, Boosters and DACT.
 - 6. A complete bill of materials listing all system components, manufacturer, quantity and part number.
 - 7. Complete details of manufacturers' warranties on equipment and Contractor's warranties on installation.
 - 8. A complete manual(s) covering installation, operation, testing, and programming of the FACP and DACT.
- D. Prepare and submit RECORD DOCUMENTATION reflecting final as-built conditions at completion of project, but before final acceptance of the work.

These documents shall be prepared in accordance with the requirements for the initial submittal. Furnish three (3) binder sets and three (3) electronic sets on thumb drives to the Owner. One additional set of documents shall be left on site at the FACP.

1.07. QUALITY ASSURANCE

A. Qualifications

1. Contractor shall be certified by the material/equipment manufacturer as trained in, and as knowledgeable of, the manufacturer's standard practices and procedures relating to installation of fire alarm systems.
2. Contractor shall utilize the services of a fire alarm equipment distributor (when applicable) which is a factory authorized representative and a stocking distributor of the equipment manufacturer and shall maintain a constant inventory of the parts typical of those used in the system installation covered under this specification. This distributor shall be located within 125 miles of the project site.
3. The fire alarm equipment distributor and installer shall each have a minimum of three (3) years of continuous experience in the design and/or installation of fire alarm systems and shall have completed a minimum of 5 projects of similar scope. It is intended that these projects incorporated similar equipment as proposed for this project.
4. Contractor shall have successfully installed fire alarm systems of the same type and design as specified herein. The Contractor shall provide evidence of such qualifications. The data shall include the names and locations of at least three installations where the Contractor has installed such systems. The Contractor shall indicate the type and design of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 18 months.
5. The Contractor shall be certified as required by the local authority, and shall provide a copy of certification.

B. Equipment and components shall bear the UL or FM label or marking, and all materials shall be new and in good condition, free of defects, scratches, corrosion and contamination. Used equipment shall not be allowed.

C. Regulatory Requirements

1. The design, equipment, materials, installation, and workmanship shall be in strict accordance with the required and advisory provisions of NFPA 70 (, NFPA 72, NFPA 101, with other applicable NFPA, Local, State and Federal codes, and with all other requirements specified herein. The advisory provisions (Appendices) of the NFPA publications referred to

herein shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears. If there are any conflicts between these specifications and the referenced standards and publications, the most stringent requirement shall apply, as determined by the Engineer.

2. Shop drawings, product data, and battery calculations shall bear the stamp of the approval authorities including the Engineer and the local Authority Having Jurisdiction.
3. Deviations from the Contract Documents and the Contractor's approved submittal documents will not be permitted without written consent from the Engineer.
4. Compliance with the Contract Drawings shall not relieve the Contractor from any specification section including strict compliance with NFPA 72, local, state, or federal requirements, and the requirements of the local Authority Having Jurisdiction.
5. All work shall be performed in a high quality, professional, highly skilled, and timely manner.

1.08. VERIFICATION

- A. The Contractor shall become familiar with all details of the work, verify all dimensions in the field and shall advise the General Contractor and Engineer of any discrepancy before performing the work.

1.09. PERMITS

- A. The Contractor shall be responsible for obtaining, and paying for, any and all permits required by federal, state and local regulations prior to beginning work at the direction of the General Contractor.

1.10. SEQUENCING

- A. All work performed shall be carried out in accordance with the applicable sections under Division 1 - General Requirements and shall adhere to the established completion schedule. Every effort shall be made to coordinate the installation of the fire alarm system with all other trades.

1.11. WARRANTY AND SERVICE AGREEMENT

- A. The Contractor shall provide, as part of the installed cost of the fire alarm system, a warranty and service agreement to cover the installation of the complete system for a period of at least one year following final system acceptance by the Owner and Engineer. This agreement shall include the following:
 - 1. Equipment and labor for all components replaced under warranty.
 - 2. Parts and labor to accomplish any manufacturer recommended upgrades or component replacements.
 - 3. Complete system inspection, testing, maintaining, and other verifications and maintenance requirements in accordance with NFPA 72 and the system manufacturer.
- B. The Contractor shall guarantee provision of emergency service coverage for the system by properly trained, experienced, and knowledgeable service technicians 24 hours per day, 7 days per week, including all holidays. The Contractor shall also guarantee a maximum call-back time of one hour and on- site response time of four hours from the initial call.
- C. The Contractor shall guarantee that all factory issued notifications related to system equipment/programming upgrades and replacements will be carried out within 14 days of initial notification by the manufacturer.

1.12. EXTRA MATERIALS

- A. At the time of the final system turnover, the Contractor shall turn over to the Owner six keys for each locked enclosure.

PART 2 PRODUCTS

2.01. MANUFACTURERS

- A. Provide a fire alarm system as specified with all components manufactured by a single manufacturer to the extent possible and shall match existing where possible. All equipment supplied under this specification shall be new, UL-listed or FM- approved for fire protection, and have been verified to be compatible with the other components of the system.

2.02. FIRE ALARM CONTROL PANEL

- A. Existing to remain.
- B. All AC power connections shall be hardwired on individual dedicated branch circuits that serve no other loads. The circuit panels chosen for the dedicated branch circuits shall not include other circuits that supply motor related loads.

The circuit and connections shall be mechanically protected within approved electrical enclosures, conduits or raceways. Each power circuit disconnecting means shall be clearly labeled "Fire Alarm System Power." The disconnecting means shall be located in a locked enclosure that is accessible only to authorized personnel. The circuit breaker shall be equipped with a lock and shall be marked in red.

- C. Normal backup power to the FACP, Boosters and DACT shall be provided with 24 V DC battery back-up that is sized to operate the complete system on standby for 24 hours. Following this 24-hour period, the batteries shall be capable of operating the system under alarm conditions for a period of five (5) minutes.
- D. The FACP, Boosters and DACT shall be equipped with integral battery chargers that automatically keep the batteries fully charged. Wires that lead from the backup battery terminals shall be fully supervised for open and short circuit conditions.
- E. The FACP, Boosters and DACT shall automatically switch to back-up battery power in the event that the incoming power level drops to eighty (80) percent of rated voltage. All system functions shall operate identically on either primary or back- up power
- F. The all electronic components shall be designed and installed such that no spurious signals or operations occur within the system, which are the result of radio/cellular phone transmissions. The system shall not be adversely affected by either a five (5) Watt hand-held two-way radio or a four (4) Watt cellular telephone being operated within 12 inches of any system panel or device.

2.03. AUXILIARY DEVICES

- A. All equipment if located in the Fire Pump House, shall carry a NEMA 3R rating.
- B. The FACP, Boosters and DACT shall be protected by a separate UL-listed fast acting electrical transit surge suppressor that incorporates low Z earth grounding. The device shall meet the requirements of U.L. 1449 and shall be housed in a separate metal latched enclosure. The enclosure shall carry a NEMA 3R rating. All penetrations into the NEMA enclosure shall be from the bottom.
- C. All low voltage circuits leading from the FACP, including initiating and notification circuits, as well as telephone lines, shall be protected by a separate U.L. listed fast-acting electrical transit surge suppressor which incorporates low Z earth grounding. The device shall meet the requirements of U.L. 497B and shall be housed in a separate metal latched enclosure. The

enclosure shall carry a NEMA 3R rating. All penetrations into the NEMA enclosure shall be from the bottom.

2.04. WIRING, RACEWAYS AND RELATED MATERIALS

- A. All wire and cable of the system shall be listed and shall fully conform to the requirements of the National Electrical Code (NEC) as well as the requirements of the panel manufacturers.
- B. All conduit, junction boxes, device boxes, terminal cabinets and related hardware and equipment shall be listed and shall fully conform to the requirements of the NEC. All conduits shall be selected such that the maximum fill capacities indicated in the NEC are not exceeded. All device boxes and junction boxes shall similarly be selected such that the fill capacities of these components are within the limits indicated in the NEC. Device mounting boxes must be selected based on proper consideration of the space taken up by the device within the box.

PART 3 EXECUTION

3.01. GENERAL

- A. Coordinate work of this Section with other affected work.
- B. The Contractor shall take any necessary measures to prevent damage to the facilities and equipment, and shall take any necessary measures to keep the premises clean at all times. Damage resulting from the work and testing under this section, whether intentional or not, shall be repaired by the Contractor at no cost to the Owner.
- C. Neither the Engineer nor Owner shall be responsible for providing a safe working place for the Contractor, subcontractors, or their employees, or any individual responsible to them for the work. The responsibility rests with the Contractor.
- D. All equipment shall be installed in an aesthetic and skilled manner in accordance with NFPA Codes and Standards and other applicable standards referenced by this document. Final appearance of all systems and equipment shall be neat and clean.
- E. The Contractor shall install the system devices and equipment in accordance with approved shop drawings.
- F. The Contractor is responsible for coordination of system requirements with all conditions of the building and site including, but not limited to, blind spaces, shelving, lights, grilles and diffusers, piping, duct work, doors, windows, equipment platforms, walls (fire-rated and non-fire-rated), beams, joists, columns, HVAC equipment, electrical panels and equipment, ceilings, areas

without ceilings, wall construction, floors and all construction, equipment and building appurtenances.

- G. Equipment, devices, apparatus, and accessories requiring normal servicing, operation and maintenance shall be made easily accessible.
- H. The system shall be complete, tested and 100% functional per the construction schedule. Any site conditions that may affect the timely completion shall be communicated to the General Contractor and Engineer as soon as discovered. Any points that cannot be fully operational due to construction shall be bypassed as to not display a trouble condition until construction allows completion.

3.02. WIRING, RACEWAYS AND ELECTRICAL BOXES

- A. AC power wiring shall be run in EMT conduit in full compliance with NFPA 70. In no case shall AC power wiring be run in the same conduit as any other fire alarm circuits. A minimum separation distance of two (2) inches between AC power or control wiring and all circuits shall be maintained within the FACP, DACT, and all other fire alarm interfaces. The exception to this would be at terminal blocks within panels or at the interface with devices. At these locations maximum possible separation shall be achieved.
- B. Wiring/cables shall be run in EMT conduit up to the elevation of the bottom member of the bar joist or roof structure member. The conduit shall be bent 90° at the top of all conduit risers so as to terminate horizontally at the bottom member and have the appropriate bushing installed. All wiring/cables shall be neatly routed and fastened in full conformance with the requirement of NFPA 70 and configured so that the structural members protect the wiring from mechanical damage. All wiring/cables that are not in conduit shall be supported by building structural members for the full running length of the wire or cable.
- C. Cable and individual conductors shall be color-coded. Different color codes shall be used for initiating circuits, power circuits and communication circuits. Color codes shall be consistent through the entire circuit run. In all circuits where polarity must be observed, two different colors shall be used.
- D. Permanent wire markers with numbers shall be used to identify the terminations of all conductors within the FACP, Boosters and the DACT. Permanent wire markers shall also be used at all devices that have numbered terminals. Provide a schedule of numbers on the appropriate drawings.
- E. In no case shall conductors be joined by splicing. Appropriate lugs and terminal blocks, or pressure connectors shall be used where conductors are joined. Wire nuts shall not be used. All terminal blocks shall be permanently

mounted to appropriate metal enclosures using metal screws. Use of adhesive strips or similar means to mount terminal blocks is prohibited.

- F. In all cases where shielded cable is used, the shielding shall be maintained continuously throughout the circuit and shall terminate to appropriate terminal screws within the FACP, DACT, and other applicable devices in full compliance with manufacturers' requirements and system listings.
- G. All wires shall be checked for grounds, shorts, opens, and correct resistance, capacitance and other applicable parameters prior to termination of the circuits at the fire alarm control panel or sub panels and prior to the installation of devices. The minimum resistance to ground or between any two conductors shall be 10 megohms, verified with a megger tester. The Contractor shall provide written documentation and certification of this testing on a per circuit basis. The Contractor shall give a minimum of 48 hours notice to the Engineer in advance of all testing so that these tests may be witnessed at the discretion of the Engineer.
- H. Where wiring and conduit penetrate fire-rated barriers appropriate fire stopping shall be put in place. Installation of materials shall result in fire resistance rating equal to or greater than the rating of the penetrated assembly, unless otherwise indicated.
- I. Wherever wiring and cabling pass through building walls, floors and roofs or is exterior to the building, it shall be enclosed in EMT or flexible conduit. Penetrations through exterior walls or roofs shall be sealed weather tight.
- J. All junction boxes shall be painted red externally. Junction box covers shall be painted red on both sides. The Contractor shall protect building structural elements and interior finishes from being painted.
- K. All junction boxes for which the circuit use is not readily discernible shall be permanently labeled.
 - 1. All junction boxes that contain devices shall be labeled. All labels shall consist of engraved phenolic signs that have been approved by the Engineer prior to installation. The use of handwriting to perform this identification is not acceptable.
- L. To prevent insulation damage or device damage, the following requirements apply:
 - 1. Any threaded EMT or flexible conduit terminating at metal boxes or cabinets shall be provided with insulating bushings at throat of connector.
 - 2. Any EMT connectors must be the all steel compressing type with insulated throats. The exception to this is indenture type that may be used on exposed unfinished areas to obtain a tighter fit to the surface.

3. Provide a clamp or other approved restraining device where cables or wires that are not in conduit enter junction boxes.
 4. Any unused, open wire entry "knock-outs" shall be sealed with the appropriate plug.
- M. All panel enclosures (NEMA 3R) installed outside or in the Fire Pump House shall be arranged so that all penetrations into the enclosure shall be through the bottom of the enclosure. Coordinate location with construction drawings.

3.03. FIELD QUALITY CONTROL AND TESTING

- A. The Contractor shall provide a qualified project superintendent for the overall management and supervision of the work.
- B. The project superintendent shall assure that adequate supervision is provided during all periods of installation of the fire alarm system. The project superintendent and all job site supervisors shall have a minimum of five years of continuous experience in the installation of fire alarm systems of similar scope and complexity.
- C. The fire alarm system shall be subject to inspection and acceptance by the Authorities Having Jurisdiction and for the purpose of determining that the system is in accordance with federal, State, local and specification requirements and applicable standards of the NFPA and other related codes.
- D. Prior to the system acceptance testing, the Contractor shall provide, in writing, certification that the installed system is in full compliance with the design documents and all applicable codes and standards. See Appendix "B" for a sample letter.
- E. The Contractor shall be responsible for performing, documenting, and certifying requisite inspection and tests in accordance with applicable codes and standards for all equipment furnished under this specification. After completing his testing, the Contractor shall demonstrate full operational capability of the fire alarm system, as well as full compliance with all design documents, codes and standards, to the Engineer.
- F. The Contractor shall perform supplemental tests and shall render additional services in connection with the fire alarm system, as directed, at no additional cost to the Owner. The effect of additional tests, if any, on the delivery schedule shall be determined prior to undertaking the test.
- G. In the event the acceptance test of the system results in the need for system repair or modification, the Contractor shall demonstrate the operability of the system to the full satisfaction of the Owner and Engineer following the completion of repairs or modification.

- H. In the event that the Authorities Having Jurisdiction require a separate demonstration of the operability of the system for acceptance purposes, this additional test shall be carried out by the Contractor without expense to the Owner.

Appendix “A”
Submittal Checklist

SUBMITTAL CHECKLIST

P = PROVIDED
N/P = NOT PROVIDED
N/A = NOT APPLICABLE

ITEM		STATUS	INITIALS
A.	Drawings		
	1. Symbol Legend		
	2. Initiating Device Locations Shown/Correct Symbols Used		
	3. Initiating Device Addresses Shown		
	4. Notification Device Locations Shown/Correct Symbols Used		
	5. Notification Device Numbers Shown		
	6. Circuit Point-to-Point Wiring to All Devices		
	7. Complete Elementary Wiring Schematics		
	8. Location of All Conduit Shown With Sizes Indicated		
	9. Table Showing:		
	a. Wire Counts		
	b. Type		
	10. Location of All Junction Boxes and fire alarm boxes		
	11. Table Indicating Color-Coding of Wires		
	12. All Relays, Modules, Auxiliary Devices Shown/Correct Symbols Used		
	13. All Drawings Same Size		
	14. All Drawings Sequentially Numbered		
B.	Complete Battery Calculations For Each Panel		

ITEM		STATUS	INITIALS
C.	Current Manufacturer's Data Sheet Identifying Component By Part Number, Type, Etc.		
	1. Boards		
	2. Modules		
	3. Amplifiers		
	4. Power Supplies		
	5. Batteries		
	6. Transponder Control Modules		
	7. Annunciator Control Modules		
	8. Remote Display Annunciator		
	9. Duct Detector, Detector Housing, Tubes		
	10. All Enclosures		
	11. All Other System Devices or Components		
	12. Print-out of Program		
	13. Installation Manual for FACP		
	14. Installation Manual for Power Supply		
	15. FACP Programming Instructions With Password Protection Levels		
	16. Bill of Materials		
	17. Manufacturers' Warranties		
	18. Installers' Warranties		
	19. Contractor Q.A. Certification		
	20. Installation Instructions Which Are Included With Packaged Devices		
D.	Wire Samples		

SECTION 13930

WET-PIPE FIRE SPRINKLER SYSTEMS

PART 1 GENERAL

1.01. SECTION INCLUDES

- A. Underground fire service mains
- B. Wet-pipe sprinkler systems
- C. System design, installation, and certification

1.02. RELATED SECTIONS

- A. Section 13851 Fire Alarm System
- B. The conditions of the Contract, including the General Conditions and Supplementary Conditions, and Division 1 - General Requirements, apply to work covered by this Section.
- C. Comply with Division 2, 13, 15, and 16 Sections, as applicable. Refer to other Divisions for coordination of work.

1.03. DEFINITIONS

- A. Equipment and materials shall be approved for their designed use and performance. The term "approved" shall mean Factory Mutual (FM) approved and/or Underwriters Laboratories (UL) listed and acceptable to the approval authorities.
- B. Approval authorities shall include Rooms To Go (Owner), authorized representative Telgian Corporation (Engineer), the General Contractor, and the local fire/code official(s), where applicable, (Authorities Having Jurisdiction).
- C. The term "Contractor" as used within this specification refers to the private underground fire service mains and/or fire sprinkler system subcontractor(s).

1.04. REFERENCES

- A. International Code Council (ICC)
 - 1. 2018 North Carolina Building Code
 - 2. 2018 North Carolina Fire Code
- B. National Fire Protection Association (NFPA)
 - 1. NFPA 13 - Installation of Sprinkler Systems

2. NFPA 20 - Installation of Centrifugal Fire Pumps
 3. NFPA 24 - Private Fire Service Mains and Their Appurtenances
 4. NFPA 25 - Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
 5. NFPA 70 - National Electrical Code
 6. NFPA 72 - National Fire Alarm Code
 7. NFPA 101 - Life Safety Code
 8. NFPA 1963 - Fire Hose Connections
- C. Underwriters Laboratories, Inc. (UL)
1. Fire Protection Equipment Directory
 2. Building Materials Directory
 3. Electrical Construction Materials Directory
- D. Factory Mutual System (FM)
1. FM Approval Guide (Latest Edition)
 2. Property Loss Prevention Data Sheet 2-0
- E. American National Standards Institute (ANSI)
1. ANSI/ASME B1.20.1 - Pipe Threads, General Purpose
 2. ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings
 3. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings, Class 150 and 300
 4. ANSI/ASME B16.4 - Cast Iron Threaded Fittings, Class 125 and 250
 5. ANSI/ASME B16.5 - Steel Pipe Flanges and Flanged Fittings
 6. ANSI/ASME B16.9 - Factory-made Wrought Steel Buttweld Fittings
 7. ANSI/ASME B16.11 - Forged Steel Fittings, Socket-Welded and Threaded
 8. ANSI/ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges
 9. ANSI/ASME B16.25 - Buttwelded Ends for Pipe, Valves, Flanges, and Fittings
 10. ANSI/ASME B36.10M - Wrought Steel Pipe
- F. American Society for Testing and Materials (ASTM)
1. ASTM A53 - Welded and Seamless Steel Pipe

2. ASTM A126 - Gray Iron Castings for Valves, Flanges, Pipe Fittings
 3. ASTM A135 - Electric-Resistance-Welded Steel Pipe
 4. ASTM A183 - Carbon Steel Track Bolts and Nuts
 5. ASTM A193 - Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
 6. ASTM A194 - Carbon and Alloy Steel Nuts and Bolts for High Pressure and High Temperature Service
 7. ASTM A197 - Cupola Malleable Iron
 8. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
 9. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
 10. ASTM F436 - Hardened Steel Washers
 11. ASTM A536 - Ductile Iron Castings
 12. ASTM A795 - Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
- G. American Welding Society (AWS)
1. AWS D10.9 - Specification for Qualification of Welding Procedures and Welders for Piping and Tubing
- H. American Water Works Association (AWWA)
1. AWWA C104 - Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
 2. AWWA C110 - Ductile Iron and Gray Iron Fittings, 3-inch Through 48-inch, for Water and Other Liquids
 3. AWWA C111 - Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings
 4. AWWA C115 - Flanged Ductile Iron Pipe and Threaded Flanges
 5. AWWA C150 - Thickness Design of Ductile Iron Pipe
 6. AWWA C151 - Ductile Iron Pipe Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
 7. AWWA C153 - Ductile Iron Compact Fittings, 3-inch through 12-inch, for Water and Other Liquids
 8. AWWA C502 - Dry-Barrel Fire Hydrants

9. AWWA C509 - Resilient-Seated Gate Valves for Water and Sewerage Systems
10. AWWA C600 - Installation of Ductile Iron Water Mains and Their Appurtenances
11. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
12. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch Through 12-inch, for Water or Other Liquids

1.05. SYSTEM DESCRIPTION

A. Underground Fire Service Mains

1. Private fire service water mains shall be provided for distribution of water to fire hydrants and fire suppression systems as indicated on the fire protection and civil drawings, and in accordance with this specification.
2. Post indicator valves (PIV) shall be provided as indicated on the fire protection and civil drawings. Each PIV shall be equipped with a valve supervisory tamper switch to be connected to the fire alarm system by others.
3. Where underground mains pass through building walls, or require a vertical rise or drop, the pipe shall be cement-lined ductile iron. Other underground piping shall be either cement-lined ductile iron or polyvinyl chloride (PVC) as indicated on the civil drawings.
4. The top of all underground mains shall have a minimum depth of cover of 36-inches below earth grade, or as required by local Authority Having Jurisdiction, or NFPA 24, whichever is greater.
5. All underground piping on the discharge side of the fire pump shall be rated with a working pressure not less than 175 psi.
6. Underground mains shall be mechanically restrained or have concrete thrust blocks installed at all changes in direction, behind tees, hydrants and dead end lines or capped tees. Mechanical joint restraints and/or thrust blocks shall be designed and installed in accordance with NFPA 24 based upon the soil resistance determined by the Soils Engineer for a minimum internal static pressure of 225 psi using a 1.5 safety factor. All stub-ins (risers and pump house) shall be mechanically restrained and have concrete thrust blocks. All rods, nuts, bolts and washers shall be painted with asphaltum paint. Corrosion protection must meet requirements of NFPA 24.

7. Guard posts shall be provided around all above ground on-site hydrants and post indicator valves subject to vehicular damage. Coordinate with drawings. The posts shall be a minimum of 6-inch Schedule 40 pipe filled with concrete. The top of each post shall be 4-feet above grade level and shall extend a minimum of 3- feet below grade. Posts shall be anchored in concrete. A minimum clear space of 3-feet shall be provided between each post and the component being protected.

B. Sprinkler Systems

1. Provide as indicated on the fire protection drawings.
2. Control Valves: Each sprinkler system riser shall be controlled by an indicating OS&Y or butterfly valve.
3. Inside Hose Stations: Provide interior fire hose connections (no hose) throughout the warehouse in accordance with the requirements of the Authorities Having Jurisdiction. Hose connections shall be protected from physical impact and permanently labeled for the system they are connected to. *Confirm locations of hose stations with owner prior to installation.*

C. Hydraulic Design Requirements

1. Sprinkler Discharge Area: The discharge area for each system shall be the hydraulically most remote area as defined in NFPA 13. The design area, for systems based on density/area design method, shall be a rectangular area having a dimension parallel to the branch lines at least 1.2 times the square root of the minimum area of operation specified.
2. Friction Losses: Losses in pipe shall be calculated in accordance with the Hazen- Williams formula with "C" values in accordance with NFPA 13.
3. Hose Stream Allowances: Include an allowance for hose streams as required by NFPA 13. Inside hose stream allowances shall be taken at the base of the riser. Outside hose stream allowances shall be taken at the nearest hydrant or connection of the sprinkler system lead-in to the underground private fire service main.
4. A minimum 10 psi cushion or safety margin between the available water supply residual pressure and the calculated system demand pressure of the hydraulically most remote system shall be incorporated into all hydraulic calculations.

D. Water Supply:

1. Hydraulic calculations shall be based on the available water supply from the water tank and fire pump being constructed adjacent to the site, as

indicated on the civil drawings. The Contractor shall conduct a flow test on this system, and submit the results of the flow test to the Engineer for review and approval prior to the preparation of the shop drawings and hydraulic calculations.

E. Location of Sprinklers

1. Location of sprinklers in relation to the ceiling and the spacing of sprinklers shall not exceed that permitted by NFPA 13 and the listing of each sprinkler. Pendent sprinklers located beneath suspended ceiling tiles shall be positioned on a center-tile basis. The spacing of sprinklers on the branch lines for open areas shall be essentially uniform. ESFR sprinklers shall be located in strict conformance to FM Loss Prevention Data Sheet 2-0.

F. Alarm and Supervisory Devices

1. Provide and install the following alarm and supervisory switches, which shall be connected to the building fire alarm control panel (FACP) by the fire alarm contractor.
 - a. Tamper Supervisory Switches: All valves directly controlling water to fire sprinklers, and the valve controlling the fire pump test header, shall be provided with tamper supervisory devices. An off-normal signal shall be initiated during the first two revolutions of a hand wheel or when the stem of the valve has moved one-fifth of the distance from its normal position, whichever is less. Each tamper supervisory device shall initiate a distinct supervisory indication.
 - b. Water Flow Switches: Each sprinkler system shall be provided with a vane- type water flow device. Water flow signals shall be priority signals and shall identify the activated flow device.

G. System Drainage

1. Drain pipes and valves shall be installed on each system to allow drainage. Each system shall drain to the maximum extent possible through the main drain valve. Discharge from drain pipes shall be to the building exterior, directed away from the building and stairs. The discharge from each drain pipe shall be piped to within 84-inch of grade. Splash blocks under each drain outlet shall be provided where necessary to prevent soil erosion.

H. Cleaning and Painting

1. All finished pipe installation shall be thoroughly cleaned of rust and in condition for painting.

2. All interior aboveground sprinkler system pipe and trim shall be painted red from the finished floor to 25 feet above the finished floor level.
 3. All outside drain pipes shall be painted to match the exterior paint color at the location of the pipe.
- I. Wet-Pipe Systems Operating Sequence
1. When a sprinkler is opened by heat from a fire, water flows to the open sprinkler.
 2. A single supervisory signal shall be generated for each individual system control valve with transmission to the FACP for tamper switch activation.
 3. A water flow signal shall be generated for transmission to the FACP upon water flow in each system equal to or greater than any one sprinkler. The flow switch shall be set for an alarm signal transmission delay of 60 seconds.
- J. Work Not Included
1. Installation of portable fire extinguishers
 2. The wiring and monitoring of alarm switches and supervisory signaling system
 3. All electrical installations

1.06. SUBMITTALS

- A. Shop Drawings
1. Prepare and submit a minimum of five (5) complete sets of detailed shop drawings indicating the proposed layout of equipment, fire service mains, risers, hangers, pipes and sprinklers. Prepare working drawings not smaller than a scale of 3/32-inch = 1-foot, on 30-inch x 42-inch drawing sheets, in accordance with all requirements for "Working Drawings (Plans)" as specified in NFPA 13. Shop drawings shall clearly indicate the locations and dimensions (to scale) of all potential obstructions or other interference to the ESFR sprinkler systems, including (but not limited to): bar joists, bottom chord bridging, x-bracing, lighting fixtures, draft curtains, duct work, powered roof exhaust ventilators, automatic smoke and heat vents, skylights, conduits, pipes, fans, etc. Submittal must be approved in writing by the Engineer and the Authority Having Jurisdiction prior to starting work.
- B. Product Data
1. Submit five (5) complete sets of descriptive data annotated to show the specific model, type and size of each item proposed. Full descriptive data

shall be submitted for all components essential to proper installation, including, but not limited to: sprinklers, pipe, fittings, gate valves, butterfly valves, check valves, hangers, flow switches, tamper switches, post indicators, underground pipe, devices, materials and associated equipment. Submittal must be approved in writing by the Engineer and the Authority Having Jurisdiction prior to starting work.

C. Hydraulic Calculations

1. Prepare and submit a minimum of five (5) complete sets of hydraulic calculations. A separate hydraulic calculation must be submitted for each sprinkler system unless otherwise pre-approved by the Engineer. Nodes or reference points for each system must be included on the shop drawings. Submittal must be approved in writing by the Engineer and the Authority Having Jurisdiction prior to starting work.

D. Submittals to the Authority Having Jurisdiction

1. Submit shop drawings, product data, and hydraulic calculations directly to the Fire Marshal's office for approval. Do not commence work until approval is obtained. Provide proof of approval to Owner. Coordinate with the local authorities' field inspecting representatives and make all adjustments or changes required to obtain approval without added cost to the contract.

E. Project Record Documents

1. Sprinkler Contractor's Superintendent shall prepare and maintain on-site, on a daily basis, red-lined shop drawings to record as-built conditions. Make red-lines available during construction for reference by the Engineer *and Owner* for construction site visits. Submit completed red-line drawings to the Engineer at project completion.
2. Prepare and submit record shop drawings, product data, and hydraulic calculations reflecting final as-built conditions at completion of project, but before final acceptance of the work. These documents shall be prepared in accordance with the requirements for the initial submittal. Freehand sketches or mark-up documents are not acceptable.

F. Operations and Maintenance Data

1. Furnish *three (3) hardcopy sets and electronic set* of instruction manuals containing complete operation and maintenance instructions for the specific make and model of fire pump, pump controller, check valves, control valves, water flow and pressure switches, valve supervisory switches and other components supplied. Include maintenance data relative to components of system, servicing requirements, inspection data,

replacement part numbers and availability, and location and numbers of service depot.

G. Contractor's Material and Test Certificates

1. Upon completion of required testing, submit completed and signed Contractor's Material and Test Certificates, for aboveground and underground piping, certifying systems meet or exceed the specified requirements.

1.07. QUALITY ASSURANCE

A. Qualifications

1. Contractor shall be certified by the material/equipment manufacturer as trained in, and as knowledgeable of, the manufacturer's standard practices and procedures relating to installation of sprinkler systems and fire pumps. The Contractor shall be certified and licensed by the state and local jurisdictions, as applicable.
2. Contractor shall be a firm specializing in performing work of this Section with a minimum of three years' experience and must be regularly engaged in making such installations.
3. Contractor shall have successfully installed automatic fire sprinkler systems of the same type and design as specified herein. The Contractor shall provide evidence of such qualifications. The data shall include names and locations of at least three installations where the Contractor has installed such systems. The Contractor shall indicate the type and design of each system and certify each system has performed satisfactorily in the manner intended for a period of not less than 18 months. The Contractor shall submit a copy of a valid state sprinkler contractor certificate and license, as applicable.
4. Contractor shall provide workers normally employed in the field and as otherwise specified in NFPA 13 and local ordinances. All material shall be new and in good condition, free of defects, scratches, corrosion and contamination. Used equipment shall not be allowed.

B. Equipment and components shall bear the UL and/or FM label or marking.

C. Regulatory Requirements

1. The design, equipment, materials, installation, and workmanship shall be in strict accordance with the required and advisory provisions of NFPA 13, to other applicable NFPA standards, Local, State and Federal codes; and to all other requirements specified herein. The advisory provisions (Appendices) of the NFPA publications referred to herein shall be

considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears. If there are any conflicts between these specifications and the referenced standards and publications, the most stringent requirement shall apply, as determined by the Engineer.

2. Shop drawings, product data, and hydraulic calculations shall bear the stamp of approval of Authorities Having Jurisdiction, including the Engineer and the Fire Marshal's office.
3. Deviations from the contract documents and the contractor's approved submittal documents will not be permitted without written consent from the Engineer.
4. Compliance with the contract documents shall not relieve the Contractor from any specification section including strict compliance with NFPA 13, NFPA 24, FM Data Sheet 2-0, local, state, or federal requirements, and the requirements of the Authority Having Jurisdiction.

1.08. DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers, with labeling in place. Maintain in place until installation.
- B. Provide temporary protective coating on cast iron and steel valves.

1.09. SEQUENCING

- A. The underground fire service mains and hydrants shall be fully functional prior to the start of combustible construction.
- B. Flushing of the underground mains and lead-ins must be completed, and witnessed by the Engineer *and Owner* before connection is made to aboveground sprinkler system piping.

1.10. GUARANTEE

- A. The Contractor, in addition to other warranties or guarantees required by the contract documents, shall guarantee workmanship on all piping, devices, and related materials for a period of one year from the date of the Engineer's final acceptance of the work. All defects shall be promptly corrected at no cost to the Owner.
- B. The Contractor is responsible for providing a system that has been coordinated with the contract documents and approved by all concerns referenced in this document including, but not limited to, the Owner, local authorities, and the Owner's representatives.

1.11. EXTRA MATERIALS

- A. Provide spare sprinklers under provisions of NFPA 13. The quantity of each type of extra sprinkler shall be as specified in NFPA 13.
- B. Provide suitable wrenches for each type of sprinkler.
- C. Provide metal cabinets for storage of spare sprinklers and sprinkler wrenches. Cabinets shall be of sufficient size to permit spare sprinklers to fit upright and reasonably secured within the cabinets. Cabinets sized such that spare sprinklers must be laid on their sides within the cabinets shall not be accepted. Cabinets shall be located at sprinkler system risers, unless otherwise indicated.

1.12. HYDRAULIC DESIGN INFORMATION SIGN

- A. Provide a permanently marked, weatherproof metal or rigid plastic sign, with the following information inscribed thereon:
 - 1. Location of the design area or areas
 - 2. Discharge densities over the design area or areas, or number and discharge pressure of calculated sprinklers, as applicable
 - 3. Required flow and residual pressure demand at the base of the riser
 - 4. Occupancy classification or commodity classification and maximum permitted storage height and configuration.
 - 5. Hose stream demand included in addition to the sprinkler demand.
- B. The lettering on the sign shall be engraved or otherwise typeset. Handwritten signs shall not be accepted.
- C. Signs shall be permanently secured to the system riser with corrosion resistant wire, chain, or other approved means.

PART 2 PRODUCTS

2.01. GENERAL

- A. All equipment supplied under this specification shall be new, and shall be UL-listed and/or FM-approved for fire protection service and installed and used as intended by the listing.

2.02. UNDERGROUND FIRE SERVICE MAINS

- A. Underground pipe shall be UL-listed or FM-approved for fire protection service and shall be Ductile Iron pipe meeting AWWA C150 and AWWA C151,

cement-mortar lined per AWWA C104, and laid per AWWA C600, or high pressure PVC pipe meeting AWWA C900 and laid per AWWA C605.

- B. The pressure class of the pipe, joints, fittings, valves and hydrants shall not be less than the maximum working pressure of the system under non-emergency (no-flow) conditions. In no case shall the pressure class be less than 175-psi.
- C. Ductile iron pipe shall be joined by mechanical or push-on joints meeting AWWA C111, cast iron flanges meeting ANSI B16.1, ductile iron flanges meeting AWWA C115, or other approved means.
- D. Fittings shall be cast iron meeting ANSI B16.1 or ductile iron meeting AWWA C110.
- E. Fire hydrants shall be high-pressure type, meeting the requirements of AWWA C502 and the Authority Having Jurisdiction. Hose threads shall have the NH standard external thread as specified in NFPA 1963, unless another thread is required by the authority having jurisdiction.
- F. Fire department connection (FDC) shall be either a Storz-type connection with location to be coordinated with local AHJ.
- G. Backflow Prevention Device: To be provided by the city.

2.03. ABOVEGROUND PIPING SYSTEMS

- A. Inspect, test and approve piping before covering, or concealing. Provide fittings for changes in direction of piping and for all connections.
- B. Welding shall be performed in the shop; field welding will not be permitted.
- C. Conceal piping, fittings, fixtures, hangers and supports in areas with suspended ceilings and finished areas.
- D. Sprinkler pipe shall be per NFPA 13, and shall be steel conforming to ASTM A-53, A-135, or A-795. Piping joined by welding or rolled-groove method shall have a minimum nominal wall thickness in accordance with Schedule 10 for sizes less than 8-inch (200 mm), 0.134-inch (3.40 mm) for 6-inch (150 mm), and 0.188-inch (4.78 mm) for 8-inch (200 mm). Piping joined by threaded methods shall be Schedule 40 for sizes less than 8-inch (200 mm) and Schedule 30 for sizes 8-inch (200 mm) and larger. Wall thicknesses less than those described above may be used if the pipe is specifically listed and has a Corrosion Resistance Ratio of at least 1.0, including when joined.
- E. Pipe shall be joined by threaded, rolled-groove, welded or flanged methods. Welding methods shall comply with all requirements of AWS D10.9, threads shall be cut to ANSI/ASME B 1.20.1, and groove dimensions shall be compatible with the listings of the couplings and fittings used. Flange gaskets

shall be red rubber sheet, 1/16-inch thick, conform to ASTM D-2000. Gaskets for grooved couplings shall be EPDM, grade E, conforming to ASTM D-2000. Grooved couplings and fittings shall be of the same manufacturer.

- F. Fittings shall be cast iron conforming to ANSI B16.1 or ANSI B16.4, malleable iron conforming to ANSI B16.3, or steel conforming to ANSI B16.5, ANSI B16.9, ANSI B16.11, ANSI B16.25, or ASTM A234.
- G. Grooved couplings and fittings shall be of the same manufacturer.

2.04. SPRINKLERS

- A. ESFR sprinklers be pendent sprinklers and shall have a nominal K-factor of 16.8 and nominal temperature rating of 165 F. All other sprinklers shall have nominal 17/32-inch or 1/2-inch orifice and a release element of ordinary temperature rating except where a higher temperature rating is necessary for individual sprinkler locations.
- B. Sprinklers (other than ESFR) in warehouse areas without suspended ceilings shall be standard- response, brass and upright type unless otherwise specified.
- C. Sprinklers in office areas with suspended ceilings shall be quick-response, ordinary temperature-rated 1/2-inch orifice recessed pendent sprinklers with chrome finish.

2.05. PIPING SPECIALTIES

- A. Wet-pipe Sprinkler System Riser Valve: Provide Riser Swing Check Valve controlled by an OS&Y or butterfly valve equipped with 2-inch main drain valve piped to exterior and inlet and outlet pressure gauges for each individual sprinkler system. Trim to include a vane-type water flow switch. Trim shall also include an Inspector's Test Connection (ITC) and grid relief valve with the discharge piped to the exterior.
- B. Water Flow Switches: Provide a paddle-type water flow switch above the sprinkler system riser valve on each individual sprinkler system. The switch shall have sensitivity setting to signal any flow of water that equals or exceeds the discharge from any one sprinkler. Water flow switch mechanisms shall incorporate a retard element, adjustable up to two minutes, which shall be set between 20 and 30 seconds. Assembly shall be rated at 175-psi cold water pressure. Switches shall be compatible with the fire alarm system and NFPA 72.
- C. Valve Supervisory Switches: Provide each sprinkler control valve, including yard post indicator valves and the two OS&Y valves on the backflow preventer in the vault, with an approved circuit supervisory (tamper) switch. The switch shall be designed to transmit a supervisory alarm signal to the

building fire alarm system. The supervisory signal shall be obtained during the first two revolutions of the hand wheel or operating crank. The switch shall not interfere with the operation of the valve, nor obstruct the view of its indicator. The trouble signal shall be obtained during abnormal interconnecting circuit conditions. Devices shall be compatible with the fire alarm system and the requirements of NFPA 72. All switches shall be suitable for installation of end-of-line devices.

- D. Pressure Gauges: Pressure gauges shall be the Bourdon-tube type with a metal corrosion-resistant case, flat glass window, 3-1/2-inch diameter with background dial with black markings, and a 0-300 psig range. Gauge accuracy shall be 3-2-3% of full range. A shutoff valve shall be provided with each gauge connection.

2.06. VALVES

- A. Provide valves as required by NFPA 13 and of types approved for fire service. Sprinkler control valves shall open by counterclockwise rotation and be of the type compatible with wall-mounted indicator posts or butterfly type. Valves 2-inch and smaller shall be bronze. Valves 2-1/2-inch and larger shall be iron bodies, bronze mounted. Valves 2-inch and smaller shall be bronze.
- B. Gate Valves
 - 1. Up to and including 2 Inches: Bronze body, bronze trim, rising stem, handwheel, inside screw, single wedge or disc.
 - 2. Over 2 Inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, single wedge, resilient- seated.
 - 3. Provide inside screw-type valves where wall-type indicator valve operators are provided.
- C. Globe Valves
 - 1. Up to 2 Inches: Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable composition disc, with backseating capacity repackable under pressure.
 - 2. Over 2 Inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, renewable seat and disc.
- D. Ball Valves
 - 1. Up to and including 2 Inches: Bronze one-piece body, stainless steel ball, Teflon seats and stuffing box ring, lever handle and balancing stops.
 - 2. Over 2 Inches: Cast steel body, chrome plated steel ball, Teflon seat and stuffing box seals, lever handle, flanged.

E. Butterfly Valves

1. Bronze body, stainless steel disc, resilient replaceable seat, threaded ends, extended neck, handwheel and gear drive and integral indicating device, and built-in tamper proof switch compatible with the fire alarm system.
2. Cast or ductile iron body, chrome plated ductile iron disc, resilient replaceable EPDM seat, extended neck, handwheel and gear drive and integral indicating device and built-in tamper proof switch compatible with the fire alarm system.

2.07. PIPE HANGERS

- A. Pipe hangers, braces and supports shall be provided in accordance with NFPA 13.
- B. Hangers for support of piping and equipment shall be types approved for fire protection service. Supports including all threaded rods shall not interfere with access to operating areas or contact building services equipment.

2.08. PIPE SLEEVES

- A. For sleeves in masonry concrete *tilt-up* walls, floors, roofs provide ASTM A53, Schedule 40 or standard weight, hot-dip galvanized steel pipe sleeves.

2.09. PIPE ESCUTCHEON PLATES

- A. Provide approved one piece or split hinge type metal plates for piping passing through floors, walls, and ceilings in exposed areas. Provide chromium-painted finish on plates in finished areas. Securely anchor plates in place with set screws or other approved means.

PART 3 EXECUTION

3.01. PREPARATION

- A. Coordinate work of this Section with other affected work.
- B. The Contractor shall take any necessary measures to prevent damage to the facilities and equipment, and shall take any necessary measures to keep the premises dry at all times. Damage resulting from the work and testing under this section, whether intentional or not, shall be repaired by the Contractor at no cost to the Owner.
- C. Prior to the operation (opening or closing) of any valve controlling water to the domestic or fire system, notification shall be given to, and approval obtained from, the Building Owner's Representative.

- D. Neither the A/E, Developer nor Owner shall be responsible for providing a safe working place for the Contractor, subcontractors, or their employees, or any individual responsible to them for the work. The responsibility rests with the Contractor.
- E. Ream pipe and tube ends. Remove burrs.
- F. Prepare piping connections to equipment with flanges or unions.
- G. All excess oil, dirt, pipe joint compound, rust and mill scale shall be removed from piping and equipment. All dirt, debris and excess cutting oil shall be removed from the interior of all piping and equipment before it is erected.
- H. *A pre-install meeting shall take place prior to any work commencing.*

3.02. INSTALLATION

- A. All equipment shall be installed in an aesthetic and skilled manner in accordance with NFPA Standards and other applicable standards referenced by this document. Final appearance of all systems and equipment shall be neat and clean. All piping in areas with finished ceilings shall be concealed. All wiring shall be in metal conduit.
- B. Inspect, test and approve piping before covering, or concealing. Provide fittings for changes in direction of piping and for all connections. Make changes in pipe sizes through tapered reducing pipe fittings; the use of bushings will not be permitted. Welding shall be performed in the shop; field welding will not be permitted. Conceal piping, fittings, fixtures, hangers and supports in areas with suspended ceilings and finished areas.
- C. Install equipment in accordance with manufacturer's instructions.
- D. Use proper lubricant on ends of piping or gaskets where required by pipe fitting or coupling manufacturer. The manufacturer's recommended lubricant shall be used.
- E. Where required by manufacturer, properly torque bolts to manufacturer's specifications using a torque wrench.
- F. All sprinklers shall be installed after the piping has been installed at ceiling level, and not while the piping is on ground level. There shall be no exceptions.
- G. Place pipe runs to minimize obstruction to other work.
- H. Insulate connection between pipe, fittings, hangers or dissimilar metal against direct contact. Use dielectric insulating flanges and units.
- I. Support all sprinkler piping as specified in applicable NFPA Standards.

- J. Provide minimum 1-1/4-inch diameter, 84-inch long nipple, cap and ball valve at ends of all cross mains for flushing connections.
- K. The Contractor shall coordinate and install equipment, piping and hangers so that it will not interfere with or be obstructed by piping, lighting, electrical conduit and wiring, structural members, air- conditioning equipment, and ceiling construction. If any such interference or obstruction exists or occurs, the Contractor shall make the necessary adjustment and/or additions to permit satisfactory installation of the system with no additional cost to the owner, architect, or engineer.
- L. Sprinkler installation shall be coordinated with the installed mechanical and electrical work and the ceiling grid/layout. Where sprinklers are to be installed on modular ceiling panels (lay-in acoustical tile), sprinklers shall be located in the center of the ceiling panel, or located in other symmetrical pattern acceptable to the Building Owner's Representative and in accordance with referenced standards and design drawings. The Contractor shall furnish additional sprinklers, which may be required for coordinated ceiling pattern without additional cost to the Owner, even though number of sprinklers may exceed minimum code requirements.
- M. The Contractor shall install the piping and equipment in accordance with approved shop drawings.
- N. Main and Auxiliary Drains
 - 1. Each system shall be furnished with a main drain capable of draining the majority of the system to drain. Drainage to floor is not permitted.
 - 2. Auxiliary drains shall be provided to drain any sections of piping that trap water or are not capable of being drained by the main drain in accordance with NFPA 13. Auxiliary drains shall discharge to the exterior unless otherwise approved by the Owner and/or Engineer.
 - 3. All outside exposed sprinkler system piping shall be galvanized pipe, and drains terminating outside shall be piped to within 4-inch of finished grade. Concrete splash blocks shall be provided at grade level beneath all outside drains to preclude soil erosion where necessary.
- O. Install piping to conserve building space, and not interfere with use of space and other work. Piping must be installed above bottom chord of joists.
- P. Group piping whenever practical at common elevations. Obstructions created by grouped piping shall be provided with additional protection as required.
- Q. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

- R. Coordinate location and method of hanging of sprinkler piping 4 in. and larger with the structural design; provide additional structural bracing where necessary. *Do not penetrate structural members without prior approval.*
- S. Tapping or drilling of load-bearing structural members is not permitted. Attachments may be made to steel or concrete structures with approved clamps and hangers designed in accordance with NFPA 13 and local standards. Any beam penetrations shall be coordinated with the structural engineer and must obtain approval from structural engineer.
- T. Provide pipe sleeves where piping passes through walls, floors, roofs, and partitions. Grout sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide clearance between exterior of piping and interior of sleeve in accordance with NFPA 13. Firmly pack space with noncombustible insulation and caulk at both ends of the sleeve with plastic waterproof cement, which will dry to a firm but pliable mass, or provide a segmented elastomeric seal. In fire-resistive rated assemblies (walls, floors, ceiling and partitions), pack space with approved firestopping materials. Installation of materials shall result in fire resistance rating equal to or greater than the assembly rating, unless otherwise indicated. Extend sleeves in floor slabs 3-inch above the finished floor.
- U. Die cut screw joints with full cut standard taper pipe threads with red lead and linseed oil or other non- toxic joint compound applied to male threads only.
- V. Install valves with stems upright or horizontal as required, not inverted. Remove protective coatings after installation.
- W. The Contractor is responsible for coordination of system requirements with all conditions of the building and site including, but not limited to, blind spaces, shelving, lights, grilles and diffusers, piping, duct work, doors, windows, equipment platforms, walls (fire-rated and non-fire-rated), beams, joists, columns, HVAC equipment, electrical panels and equipment, ceilings, areas without ceilings, wall construction, floors and all construction, equipment and building appurtenances. Contractor shall coordinate the layout of equipment, piping and materials to assure sufficient space and openings to accommodate the entire installation, and accessibility for maintenance and replacements, if necessary.
- X. Equipment, devices, apparatus, and accessories requiring normal servicing, operation and maintenance shall be made easily accessible.
- Y. Provisions shall be made by the Contractor to protect piping, sprinklers and other components of the sprinkler systems from extreme climatic conditions including freezing and high temperature.

Z. Pipe Hangers:

1. Provide a hanger, designed to prevent upward pipe movement, within 12-inch of a pendent sprinkler located at the end of a branch-line or on armovers over 12-inch in length in areas with suspended ceilings.
2. Provide a minimum of two (2) hangers per grooved pipe section greater than 6 ft. in length.
3. Hangers shall be positioned such that they are connected to pipe segments only and not to fittings.

AA. Identification signs shall be provided. Attach properly lettered approved metal signs conforming to NFPA 13 to each valve and alarm device. Permanently affix hydraulic design data nameplates to the riser of each system. Provide signs on the sprinkler control valve of each system. The sign shall identify the area of coverage controlled by the valve. Hydraulic design data nameplate information shall not be handwritten.

BB. Provide an inspector's test connection (ITC) for each sprinkler system and locate the ITC above the riser check valve. Each ITC terminating outside shall be piped to within 8-inch of finished grade. Concrete splash blocks shall be provided at grade level beneath each discharge to preclude soil erosion where necessary.

CC. Thrust Blocks

1. The trench in the area of each fitting shall be cut to provide a thrust block bearing surface on undisturbed soil.
2. Concrete shall be poured to fit snugly against as much of the fitting as possible without interfering with access to fitting joints.
3. The concrete shall be allowed a minimum curing time of five days.

3.03. ESFR SPRINKLERS (PENDENT TYPE)

- A. The sprinkler contractor shall be responsible for proper consideration of all obstructions and other installed equipment which may have an impact on the operation of ESFR sprinklers.
- B. Prior to the start of construction, the sprinkler contractor shall closely coordinate with all other trades—including, but not limited to, structural steel, mechanical, electrical, plumbing, data processing, and material handling—to ensure the water discharge from ESFR sprinklers will not be obstructed from reaching burning commodities at high volume and high momentum.
- C. The standard to be utilized in identifying ESFR sprinkler placement and obstruction issues shall be the latest version of FM Global Property Loss

Prevention Data Sheet 2-0. Any obstruction issue identified during the course of construction or acceptance inspections shall be corrected to meet the requirements of this standard at no additional cost to the Owner, architect, or engineer.

- D. Vertical duct work supplying unit heaters, if provided, shall be centered between ESFR sprinklers. The fire sprinkler contractor shall advise the general and mechanical contractors of this requirements as part of the fire sprinkler system coordination.
- E. Powered roof-top ventilators less than or equal to 4 ft. in diameter shall be positioned such that there is an ESFR sprinkler centered directly beneath the opening. If this sprinkler is less than 8 ft. from adjacent ESFR sprinklers, baffles shall be provided and installed at no additional cost.
- F. The contractor shall space ESFR sprinklers with consideration of the location of all skylights and/or roof vents so that an ESFR sprinkler is not located directly underneath a skylight or roof vent. Spacing shall take into consideration the location of any HVLS fans as necessary. Refer to architectural *and mechanical* drawings for the locations of skylights, roof vents and HVLS fans.

3.04. TESTING

- A. The system shall be subject to inspection and acceptance by the Engineer and the Authorities Having Jurisdiction for the purpose of determining the system is in accordance with federal, state, local and specification requirements and applicable standards of the NFPA and other related codes.
- B. The Contractor shall be responsible for performing and certifying requisite inspection and tests in accordance with applicable codes and standards for all equipment furnished under this specification.
- C. Inspection and testing procedures shall be submitted to the Engineer for approval prior to use.
- D. All underground piping shall be completely flushed in accordance with NFPA 13 and NFPA 24 in the presence of the Engineer. Two weeks advance notification shall be given the Engineer. Flushing procedures are subject to the approval of the Engineer and the Authorities Having Jurisdiction.
- E. All underground piping shall be hydrostatically tested at not less than 200-psi or 50 psi in excess of the maximum working pressure of the system (whichever is greater) for not less than two hours in accordance with NFPA 24. Before testing, the trench shall be backfilled between joints. All joints shall be left exposed during the test.

- F. Each hydrant shall be fully opened and closed under full system pressure, and checked for proper drainage.
- G. All interior system piping shall be hydrostatically tested at not less than 200-psi or 50 psi in excess of the maximum working pressure of the system (whichever is greater) for not less than two hours in accordance with NFPA 13. After testing and acceptance, all systems shall be returned to service and left operational.
- H. All operating parts, including electrical equipment, shall be fully tested to ensure their proper operation. All control valves shall be fully closed and opened under full system pressure.
- I. All field tests performed by the Contractor shall be conducted in the presence of the Engineer and other representatives at the Owner's option. Contractor shall provide written notification to all persons concerned two (2) weeks in advance of the tests in order to arrange attendance.
- J. The Contractor shall perform supplemental tests and shall render additional services in connection with the sprinkler system, as directed. The cost, if any, will be negotiated prior to the test. The effect of additional tests, if any, on the delivery schedule shall be determined prior to undertaking the test.

END OF SECTION 13930

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SECTION 13940

VIBRATION AND SEISMIC CONTROLS FOR FIRE SPRINKLER SYSTEMS

PART 1 GENERAL

1.01. SECTION INCLUDES

- A. Seismic control requirements.
 - 1. Includes requirements for seismic qualification of equipment not specified in this section.
- B. External seismic snubber assemblies.
- C. Seismic restraint systems

1.02. DEFINITIONS

- A. Fire Suppression Component: Where referenced in this section in regards to seismic controls, applies to any portion of the fire suppression system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., piping).
- B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.03. REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASCE 19 - Structural Applications of Steel Cables for Buildings 2016.
- C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.
- D. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment 2014.
- E. FEMA 413 - Installing Seismic Restraints for Electrical Equipment 2004.
- F. FEMA 414 - Installing Seismic Restraints for Duct and Pipe 2004.
- G. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage 2012.
- H. FM 1950 - Seismic Sway Braces for Pipe, Tubing and Conduit 2016.

- I. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components 2010, with Editorial Revision (2020).
- K. MFMA-4 - Metal Framing Standards Publication 2004.
- L. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.
- N. UL 203A - Standard for Sway Brace Devices for Sprinkler System Piping Current Edition, Including All Revisions.

1.04. ADMINISTRATIVE REQUIREMENTS

A. Coordination:

- 1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
- 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
- 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
- 4. Seismic Controls:
 - a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.
 - b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
- 5. Notify Engineer (Bass, Nixon & Kennedy, Inc.) of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

- 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured.

1.05. SUBMITTALS

- A. See Division 1 for submittal procedures.
- B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
 - 1. Seismic Controls: Include seismic load capacities.
- D. Shop Drawings - Seismic Controls:
 - 1. Include dimensioned plan views and sections indicating proposed fire suppression component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
 - 2. Identify mounting conditions required for equipment seismic qualification.
 - 3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
 - 4. Indicate proposed arrangement of distributed system trapeze support groupings.
 - 5. Indicate proposed locations for distributed system flexible fittings and/or connections.
 - 6. Indicate locations of seismic separations where applicable.
 - 7. Include point load drawings indicating design loads transmitted to structure at each attachment location.
- E. Seismic Design Data:
 - 1. Compile information on project-specific characteristics of actual installed fire suppression components necessary for determining seismic design forces required to design appropriate seismic controls.
 - 2. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.
- F. Certification for seismically qualified equipment; identify basis for certification.

- G. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.
- H. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- I. Evidence of qualifications for seismic controls designer.
- J. Evidence of qualifications for manufacturer.
- K. Manufacturer's detailed field testing and inspection procedures.
- L. Field quality control test reports.

1.06. QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.
- D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.
- E. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of experience.

1.07. DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01. SEISMIC CONTROL REQUIREMENTS

- A. Design and provide fire suppression component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor fire suppression components.

- B. Seismic Design Criteria: ICC (IBC).
 - 1. Seismic Design Category: C.
 - 2. Risk Category: II.
- C. Component Importance Factor (Ip): Fire suppression components to be assigned a component importance factor (Ip) of 1.5 unless otherwise indicated.
- D. Seismic Qualification of Equipment:
 - 1. Provide special certification for fire suppression equipment furnished under other sections and assigned a component importance factor (Ip) of 1.5, certifying that equipment will remain operable following a design level earthquake.
 - 2. Seismic qualification to be by shake table testing in accordance with recognized testing standard procedure, such as ICC-ES AC156, acceptable to authorities having jurisdiction.
 - 3. Notify Engineer (Bass, Nixon & Kennedy, Inc.) and obtain direction where mounting restrictions required by conditions of seismic certification conflict with specified requirements.
 - 4. Seismically qualified equipment to be furnished with factory-installed labels referencing certificate of compliance and associated mounting restrictions.
- E. Seismic Restraints:
 - 1. Provide seismic restraints for fire suppression components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
 - 2. Seismic Restraint Exemptions, All Seismic Design Categories:
 - a. Fire Suppression Piping Exemptions, All Seismic Design Categories:
 - 1) Lateral sway bracing for piping individually supported within 6 inches of the structure measured between the top of pipe and the point of attachment to the structure, where all conditions for exception specified in NFPA 13 are met.
 - 2) Lateral sway bracing for branch lines smaller than 2-1/2 inches in diameter, where branch line restraint is provided in accordance with NFPA 13.

3. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
 - a. ASHRAE (HVACA).
 - b. FEMA 412.
 - c. FEMA 413.
 - d. FEMA 414.
 - e. FEMA E-74.
 - f. SMACNA (SRM).
4. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.
5. External Seismic Snubber Assemblies:
 - a. Provide quantity and arrangement of external seismic snubber assemblies as required to restrain equipment in all directions (both lateral and vertical).
 - b. Do not use external seismic snubber assemblies that restrain equipment only in one or more lateral directions (but not vertical) except where uplift forces are zero or are addressed by other restraints.
6. Seismic Restraint Systems:
 - a. Arrange restraint elements to avoid obstruction of sprinklers in accordance with NFPA 13.
 - b. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
 - c. Use only cable restraints to restrain vibration-isolated fire suppression components.
 - d. Use only one restraint system type for a given fire suppression component or distributed system (e.g., piping) run; mixing of cable and rigid restraints on a given component/run is not permitted.
 - e. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain fire suppression component in all lateral directions; consider bracket geometry in anchor load calculations.

- f. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported fire suppression component weight.
- g. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported fire suppression component weight.
- h. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
- i. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
- j. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.

F. Seismic Attachments:

- 1. Comply with support and attachment requirements of NFPA 13.
- 2. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
- 3. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
- 4. Do not use power-actuated fasteners.
- 5. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps, but not for sway bracing attachments as prohibited by NFPA 13.
- 6. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
- 7. Concrete Housekeeping Pads:
 - a. Increase size of pad as required to comply with anchor requirements.

- b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.

G. Seismic Interactions:

- 1. Include provisions to prevent seismic impact between fire suppression components and other structural or nonstructural components.
- 2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.
- 3. Comply with minimum clearance requirements between other equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs.

H. Seismic Relative Displacement Provisions:

- 1. Use suitable fittings or flexible connections, in accordance with NFPA 13, to accommodate:
 - a. Relative displacements at connections between components, including distributed systems (e.g., piping); do not exceed load limits for equipment utility connections.
 - b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
 - c. Design displacements at seismic separations.
 - d. Anticipated drifts between floors.
- 2. Provide clearance around fire suppression system piping extending through walls, floors, platforms, and foundations in accordance with NFPA 13.

2.02. EXTERNAL SEISMIC SNUBBER ASSEMBLIES

A. Manufacturers:

- 1. External Seismic Snubber Assemblies:
 - a. Kinetics Noise Control, Inc: www.kineticsnoise.com.
 - b. Mason Industries: www.mason-ind.com.
 - c. Vibration Eliminator Company, Inc: www.veco-nyc.com.
 - d. Vibro-Acoustics: www.vibro-acoustics.com/#sle.
 - e. Vibration Isolation: www.vibrationiso.com.

2. Source Limitations: Furnish external seismic snubber assemblies and associated accessories produced by a single manufacturer and obtained from a single supplier.
- B. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.
- C. Seismic Snubbing Elements:
1. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
 2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

2.03. SEISMIC RESTRAINT SYSTEMS

- A. Manufacturers:
1. Seismic Restraint Systems:
 - a. AFCON, a brand of Anvil International: www.anvilintl.com/#sle.
 - b. Eaton Corporation: www.eaton.com.
 - c. Kinetics Noise Control, Inc: www.kineticsnoise.com.
 - d. Mason Industries: www.mason-ind.com.
 - e. Vibro-Acoustics: www.vibro-acoustics.com/#sle.
 - f. Vibration Isolation: www.vibrationiso.com.
 2. Source Limitations: Furnish seismic restraint system components and accessories produced by a single manufacturer and obtained from a single supplier.
- B. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.
- C. Where required by NFPA 13, provide products listed as complying with UL 203A or FM 1950.
- D. Cable Restraints:
1. Comply with ASCE 19.
 2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.

3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
 4. Use protective thimbles for cable loops where potential for cable damage exists.
- E. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

PART 3 EXECUTION

3.01. EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02. CODE-REQUIRED SPECIAL INSPECTIONS

- A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner in accordance with statement of special inspections as required by the applicable building code. Refer to Section 01 4533.
- B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
 1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
 2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.
- C. Seismic special inspections include, but are not limited to:
 1. Seismically Qualified Equipment: Verification that label, anchorage, and mounting comply with certificate of compliance.
 2. Installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units for Seismic Design Categories C, D, E, and F; periodic inspection.
 3. Installation and anchorage of vibration isolation systems for Seismic Design Categories C, D, E, and F where the approved Contract

Documents require a nominal clearance of 1/4 inch or less between equipment support frame and seismic restraint; periodic inspection.

4. Verification of required clearances between other equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs for Seismic Design Categories C, D, E, and F; periodic inspection.
- D. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.
- E. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.03. INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Comply with all requirements of NFPA 13.
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- D. Secure fasteners according to manufacturer's recommended torque settings.
- E. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
- F. Seismic Controls:
 1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris, or other obstructions.
 2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
 3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
 4. Equipment with Sheet Metal Housings:
 - a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
 - b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.

- c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
- 5. Concrete Housekeeping Pads:
 - a. Size in accordance with seismic design to meet anchor requirements.
 - b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.
- 6. Seismic Restraint Systems:
 - a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
 - b. Install restraints within permissible angles in accordance with seismic design.
 - c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
 - d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.
 - e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.04. FIELD QUALITY CONTROL

- A. See Division 1 for additional requirements.
- B. Inspect vibration isolation and/or seismic control components for damage and defects.
- C. Provide manufacturer representative or authorized technician services to execute inspection and testing of seismic controls. Submit a detailed copy of manufacturer recommended inspection, testing, and field report procedures.
- D. Seismic Controls:
 - 1. Verify snubbing element air gaps.
- E. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.
- F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION 13940

SECTION 15000

HVAC GENERAL

PART 1 GENERAL

1.01. GENERAL REQUIREMENTS

- A. Refer to Division 1 - General Requirements and any and all Supplementary or Special Requirements, all of which apply to work described in Division 15 - HVAC as if written in full herein.
- B. The scope of work described in these Specifications and/or indicated on the Drawings shall include the furnishing of all materials, equipment, appurtenances, accessories, connections, labor, etc. required and/or necessary to completely install, clean, inspect, adjust, test, balance and leave in safe and proper operating condition all HVAC systems. All HVAC work shall be accomplished by workmen skilled in the various trades involved.
- C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawings and Specifications, the higher implied cost shall be included in the bid, and the Architect shall be notified of the discrepancy in writing.

1.02. CODES AND STANDARDS

- A. All HVAC work shall conform to all ordinances and regulations of the City, County and State where the work will take place, including the requirements of all authorities having jurisdiction. The following codes, standards and references shall be observed as a minimum:
 - 1. The 2018 North Carolina State Building, Fire, Fuel Gas, Mechanical and Energy Conservation Codes
 - 2. State Amendments to the Code
 - 3. National Fire Protection Association (NFPA) Standards and Guidelines
 - 4. Local and State Fire Marshal requirements
 - 5. Local Building and Inspection Department requirements
 - 6. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE)
 - 7. Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA) Manuals

- 8. Underwriters Laboratories Inc. (UL)
- 9. Americans with Disabilities Act (ADA)
- B. If Code or other requirements exceed the provisions shown on the Contract Documents, the Engineer shall be notified in writing. Where requirements of the Contract Documents exceed Code requirements, work shall be furnished and installed in accordance with the Contract Documents. Any work done contrary to these requirements shall be removed and replaced at the Contractor's expense.

1.03. WORK INCLUDED

- A. The HVAC Systems installed and work performed under this Division of the Specifications shall include, but not necessarily be limited to:
 - 1. Airside Systems (any system that conveys air)
 - 2. Equipment: including fans, unitary air conditioners, air handling units, fan-coil units, split systems, etc.
 - 3. Ductwork and Accessories: including sheet metal, flexible ductwork, fire and smoke dampers, access doors, etc.
 - 4. Air Distribution Devices: including louvers, registers, grilles, diffusers, etc.
- B. Refrigerant Systems
 - 1. Piping, Tubing and Accessories: including pipe, refrigerant tubing, valves, solenoids, thermal expansion valves, strainers, air vents, pipe and equipment drains, condensate drains, etc.
- C. Equipment, Ductwork and Piping Supports
 - 1. Equipment Mounts: including roof curbs, concrete housekeeping pads, equipment rails, miscellaneous steel, etc.
 - 2. Hangers and Support Devices: including inserts, hanger rods, unistrut, cross-bracing, anchor bolts, pipe anchors, restraints, etc.
 - 3. Vibration Isolation and seismic restraint: including inertia bases, flexible couplings, expansion devices, snubbers, springs, waffle pads, seismic restraints, etc.
- D. Insulation
 - 1. Ductwork Insulation: including exterior duct wrap, internal duct liner, fire wrap, etc.
 - 2. Piping and Equipment Insulation: including preformed, board and wrap.

- E. Miscellaneous HVAC Equipment: Unit heaters, wall heaters, roof hoods, heat tracing, etc.
- F. Automatic Temperature Controls
 - 1. Decentralized: including all thermostats, control dampers, control valves, programmable controllers, line and low-voltage wiring, smoke detectors, pressure sensors, gas sensors, control logic, etc.
 - 2. Building Automation System (BAS): same as above but networked to a central human-machine computer interface, including all software and programming, display graphics, etc.
- G. Labor and Equipment: including project management, supervision, tradesmen, lifts, fork-trucks, cranes, scaffolding, saws, wrenches, etc.
- H. Equipment and Valve Identification
- I. Start-up and Commissioning
- J. Demonstration and Owner Training
- K. Testing, Adjusting and Balancing

1.04. ENGINEER'S DRAWINGS

- A. The locations, arrangement and extent of equipment, devices, ductwork, piping, and other appurtenances related to the installation of the HVAC work shown on the Drawings are approximate and define the intent of the design. The Contractor shall not scale Engineer's Drawings, but shall refer to the architectural drawings for exact dimensions of building components. Should a conflict exist between the architectural and engineering drawings regarding dimensions and scale, the Contractor shall notify the Architect of the discrepancy.
- B. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.

1.05. EQUIPMENT, MATERIALS AND BID BASIS

- A. Manufacturers' names, model numbers, etc. cited on the Drawings and in the Specifications are for the purpose of describing type, capacity, function and quality of equipment and materials required. All project design and coordination between disciplines has been performed as if the named manufacturer and specific piece of equipment will be provided to the project by the Contractor.

- B. Alternate equipment and/or materials other than that named on the Drawings and in the Specifications may be proposed for use, but all equipment and materials shall conform entirely to the specified base items. Proposed alternate equipment shall be substantially equal in size, weight, construction and capacity. Alternate equipment and materials shall be submitted only as full equivalent to the equipment and materials specified, with sufficient supportive documentation and technical literature to demonstrate quality, performance, and workmanship without doubt or question. Requests for prior approval of alternate products shall be made at least ten (10) days prior to the bid date and as required by Division 1 - General Requirements. The Engineer shall consider the use of the alternate equipment based on the supportive documentation made available to him, and shall approve or disapprove any proposed alternates. The decision of the Engineer shall, in all cases, be final.
- C. The Contractor shall coordinate the installation of all HVAC equipment proposed for use in this project with all building trades (architectural, structural, electrical, fire protection, etc.). Coordination shall be accomplished prior to, and shall be reflected in, the equipment submittals for approval. When the Contractor requests substitution of alternate equipment, it is with the knowledge that he shall be responsible for any and all costs required by the substitution, including necessary engineering and construction revisions in his or any other contract or trade to satisfy the design intent shown on the Plans and described in the Specifications.

1.06. SUBMITTALS

- A. The Contractor shall prepare, submit and obtain Engineer's review of all manufacturers' data on the HVAC equipment and systems prior to ordering, purchasing or installing any equipment or materials. Six (6) hard copies of the complete submittal are required, five of which will be reviewed and returned by the engineer. Electronic submittals (e.g. .pdfs, etc.) may be acceptable, if approved by the architect and described in Division 1 - General Requirements. All submittals shall be transmitted simultaneously in hard ring binders (or in a single .zip file), with the associated specification sections cited and the items submitted clearly identified. Partial submittals will be returned without review. Submittals, as a minimum, shall include:
 - 1. All HVAC items scheduled on the Drawings
 - 2. Equipment arrangement, ductwork and piping drawings. Contractor drawings shall be prepared at a minimum scale of $1/8" = 1'-0"$. A scale of $1/4" = 1'-0"$ scale is preferred. Drawings shall be indicative of actual equipment purchased and shall show all offsets, transitions, fittings, dampers, valves, hanger locations, etc. Sections are required in spatially

tight areas (e.g. offices, break rooms, mechanical rooms, etc.) The following will guide the Contractor as to minimum drawing detail required:

- a. Clearly indicate top and bottom of duct and pipe elevations. All elevations shall be coordinated as to not conflict with structural, plumbing, electrical, fire protection and architectural trades.
 - b. Indicate all offsets (both vertical and horizontal).
 - c. Indicate graphically all duct and pipe joints and their lengths.
 - d. Submit duct and pipe-work fabrication schedule indicating duct size range with minimum duct material gauges, pipe schedule being used, duct and pipe connection joint types, section lengths, duct reinforcement type and spacing, etc.
 - e. Indicate all insulation for ductwork and piping.
 - f. Indicate all dampers and valves as shown on design documents and called for in the specifications.
 - g. Indicate all flexible connectors where required by specifications and notes.
3. Flexible ductwork, duct-board, insulation and linings
 4. Dampers, louvers, air distribution devices
 5. Manufacturer's cut sheets of all piping and tubing materials
 6. Where split systems are used in a "long line application," submit manufacturer's refrigerant line set routing drawings and engineered calculations supporting the recommended suction and liquid line sizes. Identify and provide cut sheets of any and all accessories required to make the system complete, functional and reliable.
 7. Valves, thermometers, pressure gauges
 8. Roof curbs, equipment supports, hanger systems, vibration isolators, seismic restraints
 9. Control equipment, systems and diagrams
 10. Test and balance reports
- B. All submittal approvals required by any code or enforcement authority, insurance underwriter, etc. shall be obtained prior to being submitted to the Engineer.
 - C. Review of submittals by the Engineer does not relieve the Contractor from responsibility for complying with all requirements of the Contract Documents.

Furthermore, it shall be the responsibility of the Contractor to coordinate the requirements (roof penetrations, wall penetrations, floor penetrations, curbs, electrical, etc.) of all approved equipment with the other trades and disciplines.

- D. All submittals shall be identified by the equipment mark or tag identification numbers shown on the Contract Drawings. Each individual submittal item shall be marked to show which specification section pertains to the item.
- E. The Contractor shall provide a written statement confirming coordination of voltage requirements for all HVAC equipment requiring an electrical connection. Statement shall bear the names and signatures of the HVAC and electrical contractors. A photocopied reproduction of the below statement is acceptable.

VOLTAGE COORDINATION STATEMENT

This statement is to confirm that the voltages of the equipment provided under this specification have been coordinated with the Electrical Drawings, as well as with the Electrical Contractor.

HVAC Contractor: _____

Project Manager Name: _____

Project Manager Signature/Date: _____

Electrical Contractor: _____

Project Manager Name: _____

Project Manager Signature/Date: _____

1.07. PERMITS

- A. The Contractor shall obtain all permits and inspections required for the installation of the HVAC work and pay all charges incident thereto. He shall deliver copies of all certificates of permit and inspection to the Architect.

1.08. COORDINATION OF TRADES

- A. The Contractor shall give full cooperation to other trades, and shall furnish all information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.
- B. Piping and other HVAC equipment shall not be installed without first coordinating the installation of same with other trades. The Contractor, at his own expense, shall relocate all uncoordinated ductwork, piping and other HVAC equipment installed should they interfere with the proper installation

and mounting of electrical, plumbing equipment, fire protection systems, ceilings and other architectural or structural finishes.

- C. The Contractor shall coordinate the elevations of all ductwork, piping and equipment above ceilings and in exposed areas with the work of all other disciplines prior to installation.
- D. In areas where more than one trade is required to use common openings in beams, joists, chases, shafts and sleeves for the passage of conduits, raceways, piping, ductwork and other materials, the Contractor must coordinate the positions of all piping and equipment to be furnished under this section so that all items including the materials and equipment of other trades may be accommodated within the space available.
- E. The HVAC Contractor shall confirm that his work does not interfere with the clearances required for finished columns, pilasters, partitions, walls or other architectural or structural elements as shown on the Contract Documents.
- F. Work that is installed under this Contract which interferes with the architectural design or building structure shall be removed and relocated as required at no additional cost to the Contract.

1.09. OPERATION AND MAINTENANCE MANUALS

- A. The Contractor shall prepare a minimum of two (2) instruction manuals, one of which shall be submitted to the Architect for the Engineer's review. Manuals shall describe installation, operation and maintenance of all HVAC equipment and shall include copies of control schematics, sequences of operation, function and operations of all components, as well as the Contractor's name, address, and telephone number. Manuals shall also contain one copy of all manufacturers' drawings, pamphlets, data, parts lists, and instruction manual for each piece of equipment. Upon approval, one copy shall be delivered to the Owner; one copy shall be kept by the Contractor. The pamphlets and drawings are to be neatly bound in (a) 3-ring binder(s). Provide a complete electronic copy in PDF file type to owner as well.

1.10. AS-BUILT DRAWINGS

- A. The Contractor shall maintain a record of all changes in the work from that shown in the Contract Documents. The record shall be by red-line mark-up on the most current set of Engineer's Drawings kept in the field office. After all work is completed, the Contractor shall prepare a set of "as-built" reproducible drawings of similar type and quality as the Engineer's Drawings. As-built drawings shall accurately depict actual final arrangement of all HVAC items. As-built drawings shall be delivered to the Architect and Owner.

1.11. WARRANTY

- A. All equipment furnished and installed under this Contract shall be provided with the manufacturer's standard warranty unless otherwise noted.
- B. All reciprocating and scroll air conditioning compressors shall be provided with an extended 5-year parts warranty.
- C. The Contractor shall make good all defects in material, equipment, or workmanship disclosed within a period of one (1) year from date of building acceptance by the Owner. The phrase "make good" shall mean to furnish promptly, without charge, all work necessary to remedy the defects to the satisfaction of the Engineer.

1.12. START-UP-SERVICE

- A. The service of a factory-trained representative shall be provided on the jobsite for a minimum of one (1) day to provide the manufacturer's certification and start-up of all major equipment and systems including Cambridge type space heaters, HVAC cooling equipment (mini splits and rooftop units), Fans, Unit heaters, etc. A formal report is to be issued indicating any revisions required for certification of the assembly by the manufacturer. Instruction and training of the operator's personnel shall be provided following certification of the assembly.

PART 2 PRODUCTS

2.01. GENERAL

- A. All equipment, materials, accessories, etc. used shall be new and of current production unless specified otherwise. Equipment not specified in the Engineer's Drawings shall be suitable for the intended use and shall be subject to approval by the Engineer.
- B. All equipment, products and materials shall be free of defects and shall be constructed to operate in a safe manner without excessive noise, vibration, leakage, or wear.
- C. All equipment shall bear the inspection Label of Underwriters Laboratories Inc.
- D. All equipment and material for similar applications or systems shall be provided from the same manufacturer unless noted otherwise.

2.02. ELECTRICAL WORK

- A. Except as otherwise specified or noted, electrical equipment used for HVAC systems shall be as specified herein.
- B. Motor controls, system controls, starters, disconnects, pilot lights, push buttons, etc. shall be furnished by the HVAC Contractor compatible with the

apparatus that it operates. Electrical equipment shall be wired for the voltage shown on the Electrical Engineer's Drawings.

- C. Electric motors shall be high efficiency, open drip-proof type unless otherwise specified. Motors shall be standard NEMA continuous duty type and shall bear the UL Label. Motors shall be selected with a minimum of 15% safety factor greater than the fan brake/horsepower (e.g. 4.75 BHP would require a nominal 7-1/2 HP motor). The motor service factor shall not be used as part of the safety factor. All motors shall have thermal overload protection. Motors shall meet Table MG-1-12C of EPACT 1992.
- D. Motors controlled by a variable frequency drive (VFD) shall be inverter duty rated and fully compatible with the VFD provided.
- E. Starters for motors 1/3 HP and smaller shall be manual type, and for 1/2 HP and larger, shall be magnetic type. Starters shall be minimum size 0, combination type (with disconnect and lockable handle) with molded case circuit breaker. Starters for motors with remote or automatic control shall be magnetic. Relays, interlocks and auxiliary contacts shall be provided as specified and required.
- F. Magnetic motor starters shall be across-the-line, full voltage, non-reversing type unless otherwise indicated on the Drawings or specified herein. Starters for motors 75 HP and greater shall be solid state, reduced voltage type.
- G. Motor controls shall be either "Hand-Off-Auto" switches or "On-Off" push buttons with one indicating light. "Hand-Off-Auto" switches shall be provided for automatically controlled apparatus.
- H. Motor starters that are not an integral part of HVAC equipment shall be installed in conformance with Division 16 - Electrical requirements.
- I. All "loose" disconnects and starters shall be installed by Division 16.
- J. Power wiring to disconnects, starters, and equipment shall be provided and installed by Division 16. All equipment requiring electrical power shall be provided with disconnect switches at each piece of equipment. Coordinate switch type (fused or non-fused) with equipment characteristics, manufacturer's recommendations and electrical drawings.
- K. The Contractor shall provide all system controls, control and interlock wiring 120 volts and less in conduits and in accordance with materials and installation requirements of Division 16 - Electrical.
- L. All starters shall be labeled on the face of the starter with a semi-rigid plastic laminate nameplate with 1" high white letters on a black background securely affixed to the equipment. The label shall indicate equipment served by the

starter (equipment tag used on the Drawings). Labels shall be furnished and installed by the Contractor.

- M. All starters for 3-phase equipment shall have overload devices in each phase.
- N. Wiring diagrams shall be furnished by the Contractor.
- O. Acceptable manufacturers shall be General Electric, Square D, Eaton, Siemens and Allen Bradley.

PART 3 EXECUTION

3.01. GENERAL

- A. All equipment and materials shall be completely installed, adjusted, and fully operational with all accessories and connections.
- B. Equipment, piping, ductwork, etc. shall fit into the spaces provided in the building and shall be installed at such time and in such a manner as to avoid damage and as required by the job progress. The Contractor shall coordinate work with other trades and locate work described herein to avoid interferences with structural, electrical, fire protection and architectural work. Equipment, accessories and similar items requiring normal servicing or maintenance shall be accessible.
- C. The Engineer and Owner reserve the right to direct the removal of any item which, in his opinion, does not present an orderly and reasonably neat or workmanlike appearance. Such removal and replacement shall be done when directed by the Engineer and without additional cost to the Owner.
- D. Listed mounting heights are to the finished bottom of the device unless otherwise noted.
- E. All work shall be designed and installed to comply with the requirements for the seismic design category and use group for the area in which the building is constructed.

3.02. STORAGE AND PROTECTION OF MATERIALS

- A. During construction, all equipment shall be properly protected against damage, defacing and freezing with shipping cartons, plastic sheeting, shipping covers, etc.
- B. All open ends of piping and equipment shall be sealed with nipples and caps, plugs, and test plugs until final connection to system is made.
- C. All equipment, piping and ductwork shall be protected to prevent entrance of foreign matter and debris by covering exposed openings during construction.

- D. Handle and store materials in accordance with manufacturer's and supplier's recommendations and in a manner to prevent damage to materials during storage and handling. Replace damaged materials.
- E. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable to protect the equipment or materials. Equipment or materials damaged or which are subjected to these elements are unacceptable and shall be removed from the premises and replaced.

3.03. CUTTING AND PATCHING

- A. The work shall include all cutting and patching required as part of the HVAC installation. Refer to Division 1 - General Requirements.

3.04. CONCRETE WORK

- A. Construct curbs, pads and similar supports for equipment where required.
- B. Provide 4" thick housekeeping pads for all floor mounted equipment, extending 6" beyond the area occupied by the equipment. Dowel pads to structural slab.
- C. Perform concrete work in accordance with applicable portions of Division 3
- D. Concrete. Minimum compressive strength of concrete shall be same as specified for slabs on grade.
- E. Mix and install grout for HVAC equipment base bearing surfaces and anchors. Provide forms as necessary and place grout to completely fill equipment bases.

3.05. EQUIPMENT SUPPORTS

- A. Major equipment supports (structural steel frames, framed structural slab and wall openings, etc.) shall be furnished and installed by others; however, the HVAC work shall include furnishing and installation of all miscellaneous equipment supports, structural members, rods, clamps and hangers required to provide adequate support of all HVAC equipment.
- B. Unless otherwise shown on the Drawings, all HVAC equipment, piping, and accessories shall be installed level, square, and plumb.
- C. All equipment, piping, etc. supported by structural bar joists shall be supported only by the top chord of the joists. Hangers shall not be attached to the bottom chord of any joists.

3.06. PIPE AND DUCTWORK PENETRATIONS

- A. Sleeves shall be installed in all masonry or concrete walls, floors, roofs, etc. for pipe and ductwork penetrations. Sleeves for pipe shall be schedule 40 black steel. Sleeves for ductwork shall be 20-gauge galvanized steel. Sleeves shall be sized to provide a minimum of 1/4" clearance between the sleeve and pipe or duct. For insulated pipes or ducts, the clearance shall be between the sleeve and the insulation.
- B. As far as possible, all pipe and ductwork penetrations shall be provided for at the time of masonry or concrete construction. Where drilling is required, only core drills shall be used. Star drills shall not be used.
- C. All pipes penetrating walls or floors of any construction shall be installed with escutcheon plates on both sides of the penetration securely fastened to the wall or floor. In exposed areas, escutcheon plates shall be chrome plated. All escutcheon plates shall be sized to completely conceal the penetration.
- D. Ductwork penetrating walls or floors of any material shall be installed with closure plates on both sides of the penetration. Pipe penetrations through exterior walls shall be sealed weather-tight with expandable link type seals by Thunderline, Linkseal, or Engineer approved equal.
- E. All pipe and duct penetrations of fire, smoke, or fire and smoke-rated assemblies shall be fire-stopped as required to retain the integrity of the UL-rated assembly. Fire barrier products shall be as manufactured by Tremco, Hilti, 3M, Metacaulk, Nelson, or approved equal. Refer to Division 7 - Thermal and Moisture Protection.

3.07. FLASHING

- A. All piping and ductwork penetrating roofs shall be flashed in an approved manner, shall be watertight, and shall conform to the requirements detailed in Division 7 - Thermal and Moisture Protection.

3.08. EQUIPMENT LABELING

- A. All HVAC equipment shall be labeled. This shall include all central plant, air handling or air conditioning equipment, air terminals, and other similar and miscellaneous equipment.
- B. Labels for air terminals or other devices shall be located for optimum visibility through access panel or removed ceiling tiles.
- C. Rooftop equipment shall be labeled on the equipment visible from the roof as well as on the underside of the roof under the equipment, visible and readable from the slab below. Under side of roof labeling of rooftop equipment shall be, as a minimum, 4" high letters, with standard fiberboard stencils and standard black (or other appropriate color) exterior stencil enamel.

- D. Equipment labeling shall be one of the following, unless noted or specified otherwise:
 - 1. Permanently attached plastic laminated signs with 1" high lettering
 - 2. Stencil painted identification, (2" high letters for exterior of building labeling, 4" high letters for labeling of rooftop equipment under roof deck), with standard fiberboard stencils and standard black (or other appropriate color) exterior stencil enamel.

3.09. VALVE TAGS

- A. Each valve in the HVAC system is to be provided with an individually numbered valve tag.
- B. Valve tags are to be brass or plastic laminate, 1½" minimum diameter with brass chain and hook for securing to the valve.
- C. Valve tags will include a designation to indicate the appropriate system. Numbering shall be consecutive for each service of the hot, chilled, steam, condensate return, or condenser water systems.
- D. A printed list or schematic drawing shall be compiled for each system indicating the location and detailed description of the system or equipment served.
- E. One (1) copy of each list shall be framed and mounted at the location designated by the Owner. An additional copy of each list is to be included in the Operations and Maintenance Manual.

3.10. CLEANING

- A. At all times, the premises shall be kept reasonably clean and free of undue amounts of waste, trash and debris by periodic cleaning and removal. After completion, all foreign material, trash and other debris shall be removed from the job site.
- B. After all equipment has been installed, but prior to testing and balancing, all equipment, piping, ductwork, etc. shall be thoroughly cleaned both inside and out.
- C. All water piping shall be chemically flushed and cleaned prior to circulating water through equipment.
- D. After cleaning, filters shall be installed where required and all systems shall be tested and balanced.
- E. After testing and balancing and just prior to Owner review and acceptance, all systems shall be finally cleaned and left ready for use.

3.11. PAINTING

- A. Painting will be done under Division 9 - Painting except as otherwise noted, but the HVAC Contractor shall leave all surfaces of work free of rust, dirt and grease.
- B. The HVAC Contractor shall touch-up any equipment scratched in shipment or during installation to match original finish. Touch-up painting of HVAC equipment shall be part of the HVAC work.
- C. Any visible ductwork through grilles, registers and diffusers shall be painted flat black.
- D. Provide one coat of rust preventive primer on all new structural steel supports and new ferrous surfaces not galvanized, including HVAC piping. Rust preventive painting shall be part of the HVAC work. Rust preventive paint shall be "Rust Destroyer" by Advanced Protective Products, Inc., Fairlawn, NJ, (201) 794-2000. Product shall have a 5-year warranty when applied directly over rust. Clean and prepare surface per manufacturer's recommendations.
- E. All painting and coating shall match the original finish and shall conform to the requirements detailed in Division 9 - Finishes.
- F. Do not paint over equipment nameplates, nonferrous hardware, accessories or trim.

3.12. PRESSURE TESTING

- A. Unless otherwise specified herein, all HVAC piping shall be tested as required by Code to 1-1/2 times the rated system pressure or 100 psig, whichever is greater. Care shall be taken to isolate all equipment not suitable for this test pressure by installing pipe caps or blank flanges at the equipment connections. All valves and fittings shall be tested under pressure.

3.13. PERFORMANCE AND DEMONSTRATION TESTS

- A. All testing and demonstration of any and all HVAC systems required for acceptance by any authorities having jurisdiction shall be included as part of the HVAC work. This shall include the furnishing of any and all testing equipment, smoke generation devices, and any other required equipment or accessories, and all necessary labor required to perform any required tests or demonstrations. The Contractor shall coordinate and verify all devices, equipment and sequence of testing and/or events with such authorities having jurisdiction. The Contractor shall perform a minimum of two (2) satisfactory preliminary tests or demonstrations prior to any formal tests and/or demonstrations for any code authorities, and shall give a minimum of five (5)

days advance notice to the Engineer and Owner of any and all preliminary tests and/or demonstrations, indicating the date and time of such tests.

3.14. TRAINING

- A. Upon completion of the work, the Contractor shall conduct operation and training session(s) for the Owner's key operating personnel. These sessions shall be of sufficient length and duration to adequately explain the design intent and proper operating and maintenance techniques for all HVAC equipment and systems. After these sessions are completed, the Contractor shall provide a copy of a signed statement by the Owner that his personnel are thoroughly familiar with and capable of operating all HVAC equipment and systems.

END OF SECTION 15000

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SECTION 15010

VIBRATION AND SEISMIC CONTROLS FOR HVAC AND PLUMBING

PART 1 GENERAL

1.01. SECTION INCLUDES

- A. Vibration isolation requirements.
- B. Seismic control requirements.
 - 1. Includes requirements for seismic qualification of equipment not specified in this section.
- C. Vibration isolators.
- D. External seismic snubber assemblies.
- E. Seismic restraint systems.
- F. Vibration-isolated and/or seismically engineered roof curbs.

1.02. DEFINITIONS

- A. Plumbing Component: Where referenced in this section in regards to seismic controls, applies to any portion of the plumbing system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., piping).
- B. HVAC Component: Where referenced in this section in regards to seismic controls, applies to any portion of the HVAC system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., ductwork, piping).
- C. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.03. REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASCE 19 - Structural Applications of Steel Cables for Buildings 2016.
- C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.

- D. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment 2014.
- E. FEMA 413 - Installing Seismic Restraints for Electrical Equipment 2004.
- F. FEMA 414 - Installing Seismic Restraints for Duct and Pipe 2004.
- G. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage 2012.
- H. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components 2010, with Editorial Revision (2020).
- J. MFMA-4 - Metal Framing Standards Publication 2004.
- K. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.

1.04. ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Seismic Controls:
 - a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.
 - b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
 - 5. Notify Engineer (Bass, Nixon & Kennedy, Inc.) of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured.

1.05. SUBMITTALS

- A. See Division 1 for submittal procedures.
- B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
 - 1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
 - 2. Seismic Controls: Include seismic load capacities.
- D. Shop Drawings - Seismic Controls:
 - 1. Include dimensioned plan views and sections indicating proposed HVAC and plumbing component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
 - 2. Identify mounting conditions required for equipment seismic qualification.
 - 3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
 - 4. Indicate proposed arrangement of distributed system trapeze support groupings.
 - 5. Indicate proposed locations for distributed system flexible fittings and/or connections.
 - 6. Indicate locations of seismic separations where applicable.
 - 7. Include point load drawings indicating design loads transmitted to structure at each attachment location.
- E. Seismic Design Data:
 - 1. Compile information on project-specific characteristics of actual installed HVAC and plumbing components necessary for determining seismic design forces required to design appropriate seismic controls, including but not limited to the following.
 - a. Component operating weight and center of gravity.

- b. Component elevation in the building in relation to the roof elevation (z/h).
 - c. Component importance factor (I_p).
 - d. For distributed systems, component materials and connection methods.
 - e. Component amplification factor (a_p) and component response modification factor (R_p), determined in accordance with ASCE 7 tables.
 - f. Applicability of overstrength factor (for certain anchorage in concrete and masonry).
- 2. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.
- F. Certification for seismically qualified equipment; identify basis for certification.
- G. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.
- H. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- I. Evidence of qualifications for seismic controls designer.
- J. Evidence of qualifications for manufacturer.
- K. Manufacturer's detailed field testing and inspection procedures.
- L. Field quality control test reports.

1.06. QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.
- D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

- E. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of experience.

1.07. DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01. VIBRATION ISOLATION REQUIREMENTS

- A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC and plumbing equipment and/or HVAC and plumbing connections to vibration-isolated equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- C. General Requirements:
 - 1. Select vibration isolators to provide required static deflection.
 - 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
 - 3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
 - 4. Select vibration isolators for outdoor equipment to comply with wind design requirements.
 - 5. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.
- D. Equipment Isolation: As indicated in the Equipment Isolation Schedule at the end of these specifications.

2.02. SEISMIC CONTROL REQUIREMENTS

- A. Design and provide HVAC and plumbing component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor HVAC and plumbing components.
- B. Seismic Design Criteria: ICC (IBC).

1. Seismic Design Category: C.
 2. Risk Category: II.
- C. Component Importance Factor (I_p): HVAC and plumbing components essential to life safety to be assigned a component importance factor (I_p) of 1.5 as indicated or as required. This includes but is not limited to:
1. HVAC and plumbing components required to function for life safety purposes after an earthquake.
 2. HVAC and plumbing components that support or otherwise contain hazardous substances.
- D. Seismic Qualification of Equipment:
1. Provide special certification for HVAC and plumbing equipment furnished under other sections and assigned a component importance factor (I_p) of 1.5, certifying that equipment will remain operable following a design level earthquake.
 2. Seismic qualification to be by shake table testing in accordance with recognized testing standard procedure, such as ICC-ES AC156, acceptable to authorities having jurisdiction.
 3. Notify Engineer (Bass, Nixon & Kennedy, Inc.) and obtain direction where mounting restrictions required by conditions of seismic certification conflict with specified requirements.
 4. Seismically qualified equipment to be furnished with factory-installed labels referencing certificate of compliance and associated mounting restrictions.
- E. Seismic Restraints:
1. Provide seismic restraints for HVAC and plumbing components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
 2. Seismic Restraint Exemptions:
 - a. Exemptions for Seismic Design Category C:
 - 1) HVAC and plumbing components with component importance factor (I_p) of 1.0.
 - 2) HVAC and plumbing piping with component importance factor (I_p) of 1.5 and nominal pipe size of 2 inch or less; exemption does not apply to piping constructed of low-deformability materials (e.g., cast iron, glass, nonductile plastics).

- b. Ductwork Exemptions, All Seismic Design Categories:
 - 1) Ductwork not designed to carry toxic, highly toxic, or flammable gases and not used for smoke control where any of the following apply:
 - i. Trapeze supported ductwork weighing less than 10 pounds per foot.
 - ii. Hanger supported ductwork where each hanger in the duct run is 12 inches or less in length from the duct support to the supporting structure; rod hangers, where used, to be equipped with swivels.
 - iii. Ductwork having a cross sectional area of less than 6 square feet or weighing 17 pounds per foot or less, and where there are provisions to avoid impact with other ducts or mechanical components or to protect ducts in the event of such impact.
- c. HVAC and plumbing Piping Exemptions, All Seismic Design Categories:
 - 1) Trapeze supported piping weighing less than 10 pounds per foot, where all pipes supported meet requirements for exemption as single pipes described under specific seismic design category exemptions above.
 - 2) Hanger supported piping where each hanger in the piping run is 12 inches or less in length from the pipe support to the supporting structure; rod hangers, where used, to be equipped with swivels.
- 3. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
 - a. ASHRAE (HVACA).
 - b. FEMA 412.
 - c. FEMA 413.
 - d. FEMA 414.
 - e. FEMA E-74.
 - f. SMACNA (SRM).
- 4. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party

registered professional engineer acceptable to authorities having jurisdiction.

5. Seismic Type Vibration Isolators:

- a. Comply with seismic design requirements, including conditions of equipment seismic certification where applicable.

6. External Seismic Snubber Assemblies:

- a. Provide quantity and arrangement of external seismic snubber assemblies as required to restrain equipment in all directions (both lateral and vertical).
- b. Do not use external seismic snubber assemblies that restrain equipment only in one or more lateral directions (but not vertical) except where uplift forces are zero or are addressed by other restraints.

7. Seismic Restraint Systems:

- a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
- b. Use only cable restraints to restrain vibration-isolated HVAC and plumbing components, including distributed systems.
- c. Use only one restraint system type for a given HVAC or plumbing component or distributed system (e.g., ductwork, piping) run; mixing of cable and rigid restraints on a given component/run is not permitted.
- d. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain HVAC and plumbing components in all lateral directions; consider bracket geometry in anchor load calculations.
- e. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported HVAC or plumbing component weight.
- f. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported HVAC or plumbing component weight.
- g. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.

- h. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
- i. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.

8. Ductwork Applications:

- a. Provide independent support and seismic restraint for in-line components (e.g., fans, heat exchangers, humidifiers) having an operating weight greater than 75 pounds.
- b. Positively attach appurtenances (e.g., dampers, louvers, diffusers) with mechanical fasteners.

F. Seismic Attachments:

- 1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
- 2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
- 3. Do not use power-actuated fasteners.
- 4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.
- 5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
- 6. Concrete Housekeeping Pads:
 - a. Increase size of pad as required to comply with anchor requirements.
 - b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.

G. Seismic Interactions:

- 1. Include provisions to prevent seismic impact between HVAC and plumbing components and other structural or nonstructural components.

2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.
 3. Comply with minimum clearance requirements between plumbing equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs.
- H. Seismic Relative Displacement Provisions:
1. Use suitable fittings or flexible connections to accommodate:
 - a. Relative displacements at connections between components, including distributed systems (e.g., ductwork, piping); do not exceed load limits for equipment utility connections.
 - b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
 - c. Design displacements at seismic separations.
 - d. Anticipated drifts between floors.
 2. Include provisions to prevent interruption of utility service due to seismic displacements.

2.03. VIBRATION ISOLATORS

- A. Manufacturers:
1. Vibration Isolators:
 - a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
 - b. Mason Industries: www.mason-ind.com/#sle.
 - c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
 - d. Vibro-Acoustics: www.vibro-acoustics.com/#sle.
 - e. Vibration Isolation: www.vibrationiso.com.
 2. Source Limitations: Furnish vibration-isolators and associated accessories produced by a single manufacturer and obtained from a single supplier.
- B. General Requirements:
1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.

2. Spring Elements for Spring Isolators:
 - a. Color code or otherwise identify springs to indicate load capacity.
 - b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
 - c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
 - d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
 - e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
 - f. Selected to function without undue stress or overloading.
 3. Seismic Snubbing Elements for Seismic Isolators:
 - a. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
 - b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.
- C. Vibration Isolators for Seismic Applications:
1. Resilient Material Isolator Mounts, Seismic:
 - a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) isolator material; specifically designed and rated for seismic applications with integral snubbing in all directions.
 2. Restrained Spring Isolators, Seismic:
 - a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) in series with elastomeric (e.g., neoprene, rubber) isolator material within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop; specifically designed and rated for seismic applications with integral snubbing in all directions.
 - b. Bottom Load Plate: Steel with provisions for bolting to supporting structure as required.

- c. Furnished with integral leveling device for positioning and securing supported equipment.
 - d. Provides constant free and operating height.
- 3. Resilient Material Isolator Hangers, Seismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) isolator material for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
- 4. Spring Isolator Hangers, Seismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
 - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
- 5. Combination Resilient Material/Spring Isolator Hangers, Seismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) isolator material for the upper hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
 - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

2.04. EXTERNAL SEISMIC SNUBBER ASSEMBLIES

A. Manufacturers:

- 1. External Seismic Snubber Assemblies:
 - a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
 - b. Mason Industries: www.mason-ind.com/#sle.

- c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
 - d. Vibro-Acoustics: www.vibro-acoustics.com/#sle.
 - e. Vibration Isolation: www.vibrationiso.com.
- 2. Source Limitations: Furnish external seismic snubber assemblies and associated accessories produced by a single manufacturer and obtained from a single supplier.
- B. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.
- C. Seismic Snubbing Elements:
 - 1. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
 - 2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

2.05. SEISMIC RESTRAINT SYSTEMS

- A. Manufacturers:
 - 1. Seismic Restraint Systems:
 - a. AFCON, a brand of Anvil International: www.anvilintl.com/#sle.
 - b. Eaton Corporation: www.eaton.com/#sle.
 - c. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
 - d. Mason Industries: www.mason-ind.com/#sle.
 - e. Vibro-Acoustics: www.vibro-acoustics.com/#sle.
 - f. Vibration Isolation: www.vibrationiso.com.
 - 2. Source Limitations: Furnish seismic restraint system components and accessories produced by a single manufacturer and obtained from a single supplier.
- B. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.
- C. Cable Restraints:
 - 1. Comply with ASCE 19.

2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
 3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
 4. Use protective thimbles for cable loops where potential for cable damage exists.
- D. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

2.06. VIBRATION-ISOLATED AND/OR SEISMICALLY ENGINEERED ROOF CURBS

A. Manufacturers:

1. Vibration-Isolated and/or Seismically Engineered Roof Curbs:
 - a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
 - b. Mason Industries: www.mason-ind.com/#sle.
 - c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
 - d. Vibration Isolation: www.vibrationiso.com.
2. Source Limitations: Furnish vibration-isolated roof curbs and associated accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

B. Vibration Isolation Curbs:

1. Seismic Curb:
 - a. Location: Between structure and rooftop equipment.
 - b. Construction: Steel.
 - c. Integral vibration isolation to comply with requirements of this section.
 - d. Snubbers consist of minimum 0.25 inch thick resilient pads to avoid metal-to-metal contact without compromising vibration isolating capabilities.
 - e. Weather exposed components consist of corrosion resistant materials.

C. Seismic Type Nonisolated Curb and Fabricated Equipment Piers:

1. Location: Between structure and rooftop equipment.
2. Construction: Steel.
3. Weather exposed components consist of corrosion resistant materials.

PART 3 EXECUTION

3.01. EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02. CODE-REQUIRED SPECIAL INSPECTIONS

- A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner in accordance with statement of special inspections as required by the applicable building code. Refer to Section 01 4533.
- B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
 - 1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
 - 2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.
- C. Seismic special inspections include, but are not limited to:
 - 1. Seismically Qualified Equipment: Verification that label, anchorage, and mounting comply with the certificate of compliance.
 - 2. Installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units for Seismic Design Categories C, D, E, and F; periodic inspection.
 - 3. Installation and anchorage of ductwork designed to carry hazardous materials for Seismic Design Categories C, D, E and F; periodic inspection.
 - 4. Installation and anchorage of vibration isolation systems for Seismic Design Categories C, D, E, and F where the approved Contract Documents require a nominal clearance of 1/4 inch or less between equipment support frame and seismic restraint; periodic inspection.
- D. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.

- E. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.03. INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Secure fasteners according to manufacturer's recommended torque settings.
- D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
- E. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- F. Support piping connections to equipment mounted on isolators using isolators or resilient hangers to nearest flexible pipe connector.
- G. Vibration Isolation Systems:
 - 1. Spring Isolators:
 - a. Position equipment at operating height; provide temporary blocking as required.
 - b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
 - c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
 - 2. Isolator Hangers:
 - a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
 - b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
 - 3. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
 - 4. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.

5. Adjust isolators to be free of isolation short circuits during normal operation.
6. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

H. Seismic Controls:

1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris, or other obstructions.
2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
4. Equipment with Sheet Metal Housings:
 - a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
 - b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
 - c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
5. Concrete Housekeeping Pads:
 - a. Size in accordance with seismic design to meet anchor requirements.
 - b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.
6. Seismic Restraint Systems:
 - a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
 - b. Install restraints within permissible angles in accordance with seismic design.
 - c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
 - d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.

- e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.04. FIELD QUALITY CONTROL

- A. Inspect vibration isolation and/or seismic control components for damage and defects.
- B. Provide manufacturer representative or authorized technician services to execute inspection and testing of vibration isolation systems and seismic controls. Submit a detailed copy of manufacturer recommended inspection, testing, and field report procedures.
- C. Vibration Isolation Systems:
 - 1. Verify isolator static deflections.
 - 2. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.
- D. Seismic Controls:
 - 1. Verify snubbing element air gaps.
- E. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.
- F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.05. SCHEDULE

- A. Equipment Isolation Schedule.
 - 1. Roof-Mounted Fuel Fired Unit Heaters.
 - a. Base: Seismically Engineered Roof Curb.
 - 2. Roof-Mounted Fans.
 - a. Base: Seismically Engineered Roof Curb.
 - 3. Roof-Mounted Air Intake Hoods.
 - a. Base: Seismically Engineered Roof Curb.
 - 4. HVLS Fans:
 - a. Provide seismic restraints. Comply with all manufacturer's installation recommendations for seismic applications.

END OF SECTION 15010

SECTION 15020

DUCTWORK AND ACCESSORIES

PART 1 GENERAL

1.01. DESCRIPTION

- A. All work in this section shall be subject to the provisions of Section 15000 - HVAC General.
- B. Furnish and install all material, labor, accessories, etc. shown on the drawings and as specified herein to completely install all ductwork systems.
- C. Ductwork systems shall be classified as follows:
 - 1. Static pressure class +2" W.G. - from constant volume air handling unit, and terminal unit to supply diffusers, and all return and exhaust ductwork
- D. Ductwork shall be constructed according to the latest edition of SMACNA ductwork construction standards applicable to the system pressures described above, and the system material construction.
- E. Duct sizes shown on the drawings are nominal inside clear.

PART 2 PRODUCTS

2.01. DUCTWORK

- A. All ductwork shall be constructed of galvanized steel sheets of the thickness listed in the SMACNA manuals for the pressures referenced above.

2.02. FIRE DAMPERS

- A. Type B or C fire dampers with the blade stack out of the airstream shall be installed at all locations where ductwork penetrates any floor, wall or partition with a fire rating of 1 hour or more and where otherwise shown on the drawings. Fire dampers shall have a rating compatible with the floor, wall or partition, and shall be UL 555 rated. Type A fire dampers with the blade stack in the airstream may be used behind grilles or where space conditions do not permit the use of a Type B damper.
- B. All fire dampers shall be of the "Dynamic" type as classified in UL Standard 555.
- C. Slab, Wall and Partition Dampers

1. Dampers shall be factory built curtain type. They shall conform to the requirements of NFPA Standard 90 and be UL Labeled for the required rating (1-1/2 hour minimum).
2. Provide factory built sleeves of design and length to permit mounting within the opening.
3. All dampers shall be installed in strict accordance with the manufacturer's UL approved installation.
4. Where fire dampers are shown on the drawings, and if fiberglass ductwork is used, dampers shall be installed in sheet metal duct extending on both sides of the partition as required by governing code authorities.

2.03. FLEXIBLE DUCT CONNECTORS

- A. Install flexible duct connectors at connections of sheet metal duct to motor driven equipment, or otherwise noted. Flexible duct connectors shall be glass fabric coated with neoprene, suitable for the intended service. Flexible duct connectors shall be Duro Dyne Excelon or approved equal. Install per manufacturer's instructions, and support sheet metal ductwork so that no weight is supported by the flexible duct connector.
- B. Flexible connectors exposed to the weather shall be UV and ozone resistant.
- C. Fabrics, coating and adhesives shall be tested in accordance with UL 701 and have a maximum flame spread/smoke developed rating of 25/50.
- D. Flex duct connectors shall also be provided at building expansion joints.

2.04. ACCESS DOORS

- A. Hinged, gasketed and latched access doors and/or panels shall be installed at each fire and smoke damper, each duct mounted smoke detector, each valve, at each duct mounted balancing damper or any other mechanical equipment or device that requires accessibility. Doors and panels shall be sized and located to optimize access to dampers, detectors, and other equipment for service and replacement. Access doors in ductwork shall be per SMACNA Standards. Access doors and panels in walls, ceilings or other surfaces shall be coordinated with architectural finishes, and shall be as manufactured by Cesco Products.

2.05. FLEXIBLE DUCTWORK

- A. Flexible ductwork shall be UL Class I air duct.
- B. Flexible ductwork (maximum 8'-0" long) shall be installed between main supply ducts and diffusers.

- C. Take-offs shall be made using spin-in type fittings with scoop and balancing damper. Flexible ductwork shall be Thermaflex M-KE R-6 (R value = 6.0 minimum or as required by local energy code) flexible air duct or approved equal. Duct size shall be the same size as diffuser neck it serves.
- D. Flexible duct connections to ceiling diffusers shall be installed without kinks or sags to provide unrestricted airflow. Provide Flex Flow Elbow supports by Thermaflex.

2.06. AUTOMATIC CONTROL DAMPERS

- A. Automatic control dampers shall be installed as shown on the drawings and shall be controlled as described in the 15150 - Automatic Controls section of these specifications.
- B. Dampers shall be of the opposed blade type constructed of minimum 18-gauge galvanized steel and shall have rigidly constructed blades less than 6" wide, and shall have duct mounting flanges.
- C. Dampers shall be of the low leakage type with replaceable blade and jamb seals. Damper leakage shall not exceed 6 cfm per sq. ft. of damper area at 4 in. w.c.

2.07. DUCT INSULATION

- A. Not required for this project unless otherwise indicated on the mechanical drawings.

2.08. SMOKE DAMPERS

- A. Smoke dampers with airfoil shaped blades shall be installed at all locations where ductwork or supply or return air openings penetrate any floor, wall or partition with a smoke rating, or where otherwise shown on the drawings, except where such ductwork or openings are part of an engineered smoke removal system. Smoke dampers shall have a rating compatible with the floor, wall, or partition, and shall be Class I, UL555S rated.
- B. Smoke dampers shall be provided with actuators capable of closing the damper on activation of area smoke detectors or fire alarm system, and shall be normally closed. Wiring of actuators shall be by the mechanical contractor. Actuators shall be compatible with activating smoke detectors or fire alarm system (coordinate with other trades).

PART 3 EXECUTION

3.01. DUCTWORK

- A. All ductwork shall be installed in accordance with applicable SMACNA Standards according to the pressure class described in PART 1 - GENERAL.

- B. Ductwork shall be supported as recommended by SMACNA Standards from structural members. Ductwork shall not be allowed to rest on ceilings, light fixtures or structural members. Ductwork supported from joists shall be supported from the top chord of all joists.
- C. All ductwork accessories shall be installed in strict accordance with manufacturer's recommendations.
- D. All ductwork shall be leak tested in accordance with SMACNA Standards. All ductwork seams shall be sealed with mastic to provide a system that is within the allowable SMACNA leakage limits. Six (6) copies of the ductwork test report shall be submitted to the Engineer prior to the Contractor's request for final payment.
- E. All ductwork shall be cleaned inside and out prior to system start up, and shall be left in a neat and orderly manner.
- F. Ducts, unless otherwise approved, shall be true to dimensions indicated, straight and smooth on inside with neatly finished joints; securely anchor to building in an approved manner, and install to be completely free from vibration under all conditions of operation. Exact routing of ductwork will be dependent on location of framing members. Route duct to avoid cutting framing members. Duct sizes shown on drawings are inside clear dimensions.
- G. Brace ducts not more than 60 inches on center. Make slip joints in direction of flow. Unless otherwise indicated, elbows shall have a centerline radius of not less than 1 ½ times the width of the duct. Where space limitations necessitate use of short radius or square elbows, install turning vanes. Offset ducts around obstructions where possible. Where duct must encompass obstruction, area of duct shall remain constant.
- H. Duct tapers shall not exceed 1:4 ratio and transformations 30 degrees between air flow and diverging or converging air flow. Provide access doors for access to all equipment, dampers and motors concealed by sheet metal.

3.02. DAMPERS

- A. Install dampers where indicated on drawings. Provide friction damper behind face of each supply outlet which shall be adjustable through the face of the grille with a screwdriver.

END OF SECTION 15020

SECTION 15030

LOUVERS, GRILLES, REGISTERS AND DIFFUSERS

PART 1 GENERAL

1.01. DESCRIPTION

- A. Furnish and install all louvers, grilles, registers and diffusers of the size, type, capacity, and characteristics as shown on the equipment schedules and described herein.
- B. Equipment schedules and specifications are based on the one manufacturer listed in the schedule. Other manufacturers of equal quality and performance may be submitted to the Engineer for review. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

PART 2 PRODUCTS

2.01. LOUVERS

- A. Louver components (heads, jambs, sills, blades, etc.) shall be factory assembled by the manufacturer into a complete unit. Louver sizes too large for shipping shall be built-up by the Contractor from factory assembled louver sections to provide the overall sizes required.
- B. Louver design shall incorporate structural supports required to withstand a wind load of 20 lbs. per square foot.
- C. All louver performance data submitted for approval shall bear the AMCA Certified Ratings Seal for Air Performance and Water Penetration.
- D. All louvers shall have a standard factory applied finish coating with color selection made by the Architect at the time of shop drawing approval. Color charts shall be submitted with louver shop drawings.

2.02. GRILLES, REGISTERS AND DIFFUSERS

- A. Units shall be of the type, size, and construction as scheduled on the Drawings.
- B. Unless otherwise noted on the Drawings, all units shall be supplied with a factory finish of white baked enamel.
- C. Grilles, registers and diffusers shall be ordered with borders compatible with the ceiling system type in which they are installed.

- D. Aluminum devices shall be used for all areas subject to excessive moisture or humidity (e.g. showers, bathrooms, etc.).

1.02. ROOF HOODS

- A. Fabricate air inlet or exhaust hoods in accordance with SMACNA (DCS).
- B. Fabricate of galvanized steel, minimum 16 gauge, 0.0598 inch base and 20 gauge, 0.0359 inch hood, or aluminum, minimum 16 gauge, 0.0598 inch base and 18 gauge, 0.0598 inch hood; suitably reinforced; with removable hood; birdscreen with 1/2 inch square mesh for exhaust and 3/4 inch for intake, and factory prime coat finish.
- C. Color: As indicated on the architectural or mechanical drawings. Provide color palette for color approval by architect.
- D. Fabricate louver penthouses with mitered corners and reinforce with structural angles.
- E. Mount unit on minimum 12 inch high curb base with insulation between duct and curb.
- F. Make hood outlet area minimum of twice throat area.

PART 3 EXECUTION

3.01. LOUVERS

- A. Louvers shall be installed according to manufacturer's recommendations, and shall be caulked and sealed at the frame and flanges to make the installation weatherproof.
- B. Combination louver dampers shall be installed with required damper operators and linkage mechanisms and shall be field adjusted for full opening/closure stroke. Louvers shall be interlocked as indicated on the Drawings.

3.02. GRILLES, REGISTERS AND DIFFUSERS

- A. All units located in ceiling tiles shall be centered or shall be on quarter points of 2 ft. x 2 ft. tiles.
- B. Where a line of sight allows the ductwork, wall or ceiling structure to be seen behind any units, such ductwork, wall or ceiling structure shall be painted with nonflammable flat black paint to minimize visibility.
- C. All units not installed on T-bar ceiling grids shall be securely fastened to adjacent structures.

- D. Where air distribution devices are installed in inaccessible ceilings, provide spin-in with scoop without volume damper. Provide opposed blade damper in neck of air distribution device with access to damper control through face.

1.03. ROOF HOODS

- A. Install in accordance with manufacturer's instructions.
- B. Coordinate installation of roof hood curbs with GC and roofing contractor. Secure roof hoods to curbs per manufacturer's instructions.

END OF SECTION 15030

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SECTION 15150
AUTOMATIC CONTROLS

PART 1 GENERAL

1.01. GENERAL REQUIREMENTS

- A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 15000 - HVAC General.
- B. Furnish and install a complete system of automatic controls of the type and characteristics and which will perform the functions described herein and on the Drawings.
- C. All equipment, labor, tubing, etc. required to accomplish the control sequences outlined in this section shall be furnished as part of the HVAC work.
- D. All other HVAC equipment purchased and installed as described in other sections of these specifications shall be coordinated with the requirements of this section to assure compatibility and function.
- E. All electrical control wiring required as part of this work shall be furnished and installed as part of the HVAC work and shall be installed in accordance with Division 16.
- F. This section generally describes the desired operating sequence and characteristics of all HVAC systems provided and installed as part of Division 15 of these specifications. The preparation of the detailed control schematics necessary to accomplish the desired systems operation shall be included as part of the HVAC work. Six (6) copies of these control schematics shall be submitted and reviewed by the Engineer as part of the Shop Drawings prior to the purchase or installation of any control equipment or other equipment that depends on these control schemes for proper operation.
- G. All major control equipment shall be located in a suitable enclosure in the mechanical room.

PART 2 PRODUCTS

2.01. GENERAL

- A. Only those products of particular importance to appearance or function are described in this Products section. Other items required for satisfactory systems operation but not herein described shall be furnished and installed to meet the intent and Operating Sequences herein described.

2.02. PROGRAM CLOCK

- A. Program clock shall be 7 day programmable digital time-clock, tork or equal by paragon.
- B. Units shall be mounted 4'-0" AFF.

2.03. AUTOMATIC CONTROL DAMPERS

- A. Dampers shall be of the opposed blade low leakage type with polyurethane blade seals and stainless steel jamb seals.
- B. Leakage shall not exceed 1% of full air flow at 4" WG and below (based on 1,500 FPM approach velocity).
- C. Units shall be full size of ductwork with duct mounting flanges as shown on the Drawings.
- D. Units shall be Robertshaw D211 or equal with required operators.

2.04. AUTOMATIC SHUTDOWN OF RECIRCULATING AIR SYSTEMS

- A. All fans supplying more than 2,000 cfm of air to any space and all recirculating fan systems serving areas of egress shall be installed with a smoke detector in the supply ductwork. Duct smoke detectors shall be installed in the return air path of air distribution systems utilizing a common supply and/or return air plenum with a combined design capacity greater than 2,000 cfm.
- B. The smoke detector shall be wired to stop the fan upon detection of smoke, and signal the building fire alarm control panel. The smoke detector shall be furnished by the Electrical Contractor, mounted in the duct by the HVAC Contractor, and wired by the Electrical Contractor.
- C. A reset switch shall be provided to switch the roof top unit back on incase of automatic shutdown by the smoke detector. The reset switch shall be located in the maintenance area, in a similar locking cover as the thermostats.
- D. Firestats may be substituted for smoke detectors in "A" above if permitted by local code authority. Firestats shall otherwise be installed as required by local code authorities.

2.05. HVAC EMERGENCY SHUTDOWN

- A. Manual over-ride control (emergency shut-down) switch for all HVAC units shall be located in a locking cover adjacent to the fire alarm annunciator panel or other location approved by the authority having jurisdiction.
- B. Provide motor starter(s) with auxiliary contactor to accomplish Item A above.

PART 3 EXECUTION

3.01. OPERATING SEQUENCE

- A. All units and systems shall be controlled as described on the Drawings and as recommended by equipment manufacturers.

END OF SECTION 15150

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SECTION 15160

GAS-FIRED UNIT HEATERS

PART 1 GENERAL

1.01. DESCRIPTION

- A. Furnish and install all gas-fired unit heaters of the size, type, capacity and characteristics as shown on the equipment schedules and herein described.
- B. Equipment schedules and specifications are based on the one manufacturer listed on the schedule. Other manufacturers of equal quality and performance may be submitted to the Engineer for review. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

PART 2 PRODUCTS

2.01. GAS FIRED INDUSTRIAL HEATERS

- A. Manufacturers:
 - 1. Cambridge Air Solutions; Model S-Series HTHV Heater:
www.cambridgeair.com.
- B. General:
 - 1. Heater shall be manufactured, assembled and factory tested to assure proper alignment of assemblies and performance of controls and other components.
 - 2. Heaters shall be design certified by CSA International to be in compliance with ANSI Standard Z83.4 - CSA 3.7 for Non-Recirculating Direct Gas-Fired Industrial Air Heaters and be labeled ASHRAE 90.1 compliant.
 - 3. Heaters shall be capable of achieving a 160°F temperature rise with a discharge temperature of 160°F at 0°F outdoor temperature in accordance with the terms of the certification.
 - 4. The standard heater mounting package, including all specified components, shall be roof top as indicated on the mechanical drawings.

C. Construction:

1. Each heater shall be constructed with the burner section located at the blower discharge, isolating the blower, motor, drive and control components from operationally detrimental high temperatures.
2. The construction of each heater shall be built around a structurally reinforced, unitized housing and base made of G90 galvanized steel and shall be painted with a gray polyester powder paint finish.
3. Outdoor heaters shall have watertight access panels to the blower, motor and drive, and gas train.
4. The controls enclosure shall be directly accessible from the exterior of the heater and shall be watertight with a full length, continuous stainless steel hinge and full perimeter gasket seal.

D. Blower:

1. The blower shall be constructed with a discharge transition duct which is approximately 2-1/2 wheel diameters in length to provide maximum regain of static pressure and uniform discharge air temperature.
2. The blower shall be a double width double inlet (DWDI), forward-curved centrifugal fan with a painted housing.
3. The fan wheel shall be statically and dynamically balanced.
4. The fan bearings on Series S400, S800, S950, S1200 (with 3 HP motors) heaters shall have permanently lubricated self-aligning sealed ball bearings, resiliently mounted for sound and vibration attenuation.
5. The fan bearings on Series S1200 (with 5 HP motors), S1600, S1850, S2200, and S3200 heaters shall have self-aligning, sealed ball bearings with grease fittings.
6. Fan bearings shall be located out of the heated air stream.
7. Fan speed shall be at least 25% below the first critical speed for the shaft.
8. The shaft shall be coated with a rust inhibitor.
9. Bearing slingers shall be provided to minimize airborne moisture access to the fan bearings.

E. Motor/Drive:

1. The motor shall be ball bearing type, open drip-proof construction, designed for continuous duty at the specified horsepower and voltage, and shall have a 1.15 service factor.

2. The motor bearings shall be located out of the heated air stream.
 3. The motor mount shall be on an adjustable sliding base.
 4. The fan drive shall be a heavy duty V-belt drive designed for a 1.5 minimum service factor based on motor horsepower.
- F. Burner:
1. The direct gas-fired burner shall be suitable for natural gas.
 2. The burner shall have stainless steel burner plates with non-clogging orifices.
 3. The burner shall produce less than 5 PPM (parts per million) carbon monoxide and 0.5 PPM nitrogen dioxide over its entire firing range.
 4. The burner shall be warranted for five years.
 5. The burner shall be furnished with a low voltage/hot surface ignition system and stainless steel flame rod.
- G. Gas Controls:
1. The temperature control system shall be EDL (Electronic Discharge Local) for all heaters, utilizing the Maxitrol Series 14 modulation controls.
 2. A gas valve leak test switch shall be provided to permit field verification of the gas tightness of the valve seats for heaters over 400,000 BTU/hr.
 3. A high gas pressure switch shall be provided for applications where the gas supply pressure to the heater exceeds 14" WC.
 4. Controls:
 5. The heater shall be furnished with factory mounted controls to include low temperature cutout, entering air thermostat, pre-purge timer, patented low fire start control, service switches for blower and burner operation at the heater, non-fused disconnect switch, IEC motor starter with single phase overload protection, redundant gas valves, pressure regulator, electronic temperature controls and a low voltage, class 2 transformer for remote control wiring.

PART 3 EXECUTION

3.01. GENERAL

- A. Unit shall be installed in strict accordance with manufacturer's recommendations.

END OF SECTION 15160

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SECTION 15400

PLUMBING GENERAL

PART 1 GENERAL

1.01. GENERAL REQUIREMENTS

- A. General Conditions: Refer to the General Conditions, the Supplementary General Conditions and the Special Conditions, all provisions of which apply to work under this section as if written in full herein.
- B. The scope of work described in these Specifications and/or indicated on the Drawings shall include (except where otherwise noted) the furnishing of all materials, equipment, appurtenances, accessories, connections, labor, etc. required and/or necessary to completely install, clean, inspect, adjust, test, balance and leave in safe and proper operating condition all systems. All work shall be accomplished by workmen skilled in the various trades involved.
- C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawing and Specifications, the higher cost shall be included, and the Engineer shall be notified of the discrepancy.
- D. All work performed under this specification shall be accomplished in accordance with the requirements and provisions of Section 15000 - HVAC General.

1.02. STANDARDS

- A. All Plumbing systems shall conform to all ordinances and regulations of the City, County, State and/or other authorities having jurisdiction in accordance with the requirements of the following codes, standards and design guides.
 - 1. The North Carolina Plumbing Code, 2018 Edition
 - 2. The North Carolina Building Code, 2018 Edition
 - 3. The North Carolina Gas Code, 2018 Edition
 - 4. North Carolina Energy Conservation Code, 2018 Edition
 - 5. Americans with Disabilities Act (ADA)
 - 6. ANSI/NSF 61 compliance is required for all components of the domestic water system.
 - 7. American Society of Plumbing Engineers (ASPE) Data Books

8. National Fire Protection Association (NFPA) Standards:
 - a. NFPA 30 - Flammable and Combustible Liquids Code
 - b. NFPA 31 - Oil Burning Equipment
 - c. NFPA 54 - National Fuel Gas Code
 - d. NFPA 58 - Liquefied Petroleum Gases
 9. Plumbing Drainage Institute (PDI)
 10. Underwriters Laboratories Inc. (UL)
 11. National Sanitation Foundation (NSF)
 12. Local and State Fire Marshal requirements
 13. Local Building and Inspection Department requirements
 14. Local Health Department requirements
- B. If code or other requirements exceed the provisions shown on the Contract Documents, the Engineer shall be notified in writing. Where requirements of the Contract Documents exceed code requirements, work shall be furnished and installed in accordance with the Contract Documents. Any work done contrary to these requirements shall be removed and replaced at the Contractor's expense.

1.03. PERMITS

- A. The Contractor shall obtain all permits and inspections required for the installation of this work and pay all charges incident thereto. He shall deliver to the Architect all certificates of said inspection.

1.04. WORK INCLUDED

- A. Systems
1. The Plumbing Systems installed and work performed under this Division of the Specifications shall include, but not necessarily be limited to, the following as noted below. The connection point for all systems from the site utilities shall be as 5'-0" from the exterior of the building unless specifically otherwise noted.
 - a. Domestic cold, hot and hot water recirculation systems
 - b. Sanitary, drainage, waste and vent systems
 - c. Natural gas/propane gas system
 - d. Primary and emergency storm drainage systems

- e. Propane/air mixture gas systems
- f. Domestic water softening system
- g. Compressed air system
- h. Fuel Oil system

1.05. DRAWINGS

- A. The Drawings are diagrammatic and do not necessarily depict exact conditions. The indicated locations of equipment, ductwork, piping, etc. are approximate only. The Drawings are schematic in nature and are not to be scaled. Scales are shown for reference and approximation only. Refer to the architectural drawings for dimensional data of building components.
- B. The locations, arrangement and extent of equipment, devices, and other appurtenances related to the installation of work shown on the Drawings are approximate. The Contractor shall not scale drawings, but shall refer to the architectural drawings for exact dimensions of building components. Should a conflict exist between the architectural and engineering drawings regarding dimensions and scale, the Contractor shall notify the Architect of the discrepancy for resolution.
- C. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.

1.06. OPERATION AND MAINTENANCE MANUALS

- A. The Contractor shall prepare a minimum of three (3) instruction manuals describing installation, operation and maintenance of all Plumbing equipment. Manuals shall include copies of control schematics, sequences of operations, indicate the function and operations of all components, as well as the Contractor's name, address, and telephone number. Manuals shall also contain one copy of all manufacturers' drawings, pamphlets, data, parts lists and instructions manual for each piece of equipment. The pamphlets and drawings are to be neatly bound in a 3-ring binder(s) for the Owner's use. An electronic copy shall also be issued.
- B. Prior to final acceptance by the Owner, the Contractor shall submit a complete as-built drawing submittal for the Owner's review, three (3) sets of operating and maintenance manuals, spare parts lists, drawings, wiring diagrams, troubleshooting data, manufacturer's bulletins, and other pertinent data on all equipment furnished under this Contract. Each set shall be

enclosed in a suitable hard cover binder. An electronic copy shall also be provided.

- C. A complete set of reproducible as-built drawings shall be provided indicating the location of all piping dimensionally located from a minimum of two column lines or major building structures. Drawings shall be a minimum of 1/8" scale.
- D. Provide name, address and telephone numbers of the manufacturer's representative and service company for each piece of equipment installed in the as-built submittal package.
- E. Provide all loose keys for supply valves, wall hydrants and hose bibbs installed.
- F. Provide a full repair kit set (total relief valve kit, first check and second check kits) for each reduced pressure backflow preventer installed.

1.07. AS-BUILT DRAWINGS

- A. The Contractor shall maintain a record set of drawings indicating all changes in the work from that shown in the Contract Documents. Prior to final acceptance by the Owner, the Contractor shall assemble the complete set of as-built drawings that accurately reflects all changes to indicate actual final construction. All concealed piping shall be dimensionally located from at least two (2) column lines or major building structure elements. Drawings shall be a minimum of 1/8" scale.
- B. The original set of "as-built" drawings shall be scanned and transmitted to the Owner in both full size mylar and CD format.

1.08. EQUIPMENT, MATERIAL BID BASIS

- A. Manufacturers' names, model numbers, etc. as specified on the Drawings and herein are for the purpose of describing type, capacity, function and quality of equipment and materials required.
- B. Unless "approved equal" is specifically stated, bids shall be based on equipment named in Specifications or on Drawings as "base" products. Proposed alternate equipment and materials may be submitted along with the "base" products, provided deductive pricing is included with the alternate.
- C. Alternate "approved equal" items listed shall conform to specified base items and shall be substantially equal in quality, size, weight, construction, capacities and performance. The alternate equipment and materials shall be submitted as full equivalent to the equipment and materials specified, with sufficient supportive documentation and technical literature to demonstrate quality, performance, and workmanship without doubt or question. The Engineer shall consider the use of the alternate equipment based on the

supportive documentation and other information available to him, and shall approve or disapprove any alternates. The decision of the Engineer shall in all cases be final.

- D. The Contractor shall coordinate the installation of all plumbing equipment proposed for use in this project with all building trades (architectural, structural, mechanical, fire protection and electrical). Coordination shall be accomplished prior to, and shall be reflected in, the submittal of shop drawings for approval. Any modifications or revisions required by other trades as a result of the use of equipment other than the basis of design shall be made at no additional cost. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

1.09. START-UP-SERVICE

- A. The service of a factory-trained representative shall be provided on the jobsite for a minimum of one (1) day to provide the manufacturer's certification and start-up of all major equipment and systems including booster pumps, water heaters, sewage ejectors, lift stations, fuel oil systems, etc. A formal report is to be issued indicating any revisions required for certification of the assembly by the manufacturer. Instruction and training of the operator's personnel shall be provided following certification of the assembly.

1.10. SUBMITTALS

- A. The Contractor shall prepare, submit, and obtain Engineer's review of manufacturers' submittals on the following equipment and systems prior to ordering, purchasing, or installation of any equipment or materials. All required submittals shall be transmitted simultaneously in hard ring binders (or electronic) with the associated specification section and the item submitted clearly identified. Partial submittals will be returned without review.
 - 1. Plumbing fixtures, faucets and trim
 - 2. Water heaters and storage tanks
 - 3. Domestic water pressure booster system
 - 4. Insulation
 - 5. Floor drains and drainage accessories
 - 6. Hydrants and hose bibbs
 - 7. Mixing valves
 - 8. Submersible pumps

- 9. Hot water return pumps
 - 10. Backflow preventers
 - 11. Grease/oil interceptors
 - 12. Pipe and fittings
 - 13. Valves
 - 14. Pipe supports
 - 15. Piping accessories
 - 16. Pipe labels and valve tags
- B. All approvals required by any code or enforcement authority, insurance underwriter, etc. shall be obtained prior to equipment being submitted to the Engineer.
 - C. Review of submittals by the Engineer does not relieve the Contractor from the responsibility for complying with all requirements of the Contract Documents. Furthermore, it shall be the responsibility of the Contractor to coordinate the requirements of all approved equipment with other trades and disciplines such as roof openings, wall openings, electrical characteristics, etc.
 - D. All submittals shall be identified by the equipment mark or tag identification numbers shown on the Contract Drawings. Each individual submittal item shall be marked to show which specification section pertains to the item.
 - E. Submittals shall clearly indicate selection of model numbers, sizes, dimensions, electrical characteristics, etc. of the proposed equipment. Any proposed deviations from specified equipment shall be clearly indicated on the submittal.

- F. Included with submittals of plumbing equipment requiring electrical connections shall be a written statement confirming coordination of voltage requirements, bearing the names and signatures of the plumbing and electrical contractors. A photocopied reproduction of the below statement is acceptable.

VOLTAGE COORDINATION STATEMENT

This statement is to confirm that the voltages of the equipment provided under this specification have been coordinated with the Electrical Drawings, as well as with the Electrical Contractor.

Plumbing Contractor: _____

Project Manager Name: _____

Project Manager Signature/Date: _____

Electrical Contractor: _____

Project Manager Name: _____

Project Manager Signature/Date: _____

1.11. COORDINATION OF TRADES

- A. The Contractor shall give full cooperation to other trades, and shall furnish all information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay.
- B. Piping and other plumbing equipment shall not be installed without first coordinating the installation of same with other trades. The Contractor, at his own expense, shall relocate all uncoordinated piping and other plumbing equipment installed should they interfere with the proper installation and mounting of electrical, fire protection, HVAC equipment, ceilings and other architectural or structural finishes.
- C. The Contractor shall coordinate the elevations of all piping and equipment above ceilings and in exposed areas with the work of all other disciplines prior to installation.
- D. In areas where more than one trade is required to use common openings in beams, joists, chases, shafts and sleeves for the passage of conduits, raceways, piping, ductwork and other materials, the Contractor must coordinate the positions of all piping and equipment to be furnished under this section so that all items including the materials and equipment of other trades may be accommodated within the space available.

- E. The Contractor shall confirm that work installed under this section does not interfere with the clearances required for finished columns, pilasters, partitions, walls or other architectural or structural elements as shown on the Contract Documents.
- F. Work that is installed under this Contract which interferes with the architectural design or building structure, shall be removed and relocated as required at no additional cost to the Contract.
- G. All offsets, fittings, valves, devices and accessories which may be required are to be provided under this Contract. The Contractor shall examine the entire set of Contract Documents and carefully investigate the structural and finish conditions affecting all his work and shall arrange such work accordingly for the complete satisfactory operation of all systems, providing such fittings, traps, valves, devices and accessories as may be required to meet such conditions.

1.12. WARRANTY

- A. All equipment furnished and installed under this Contract shall be provided with the manufacturer's standard warranty unless otherwise noted.
- B. The Contractor shall make good all defects in material, equipment, or workmanship disclosed within a period of one (1) year from date of building acceptance by the Owner. The phrase "make good" shall mean to furnish promptly, without charge, all work necessary to remedy the defects to the satisfaction of the Engineer.

PART 2 PRODUCTS

2.01. GENERAL REQUIREMENTS

- A. All equipment, materials, accessories, etc. used shall be new and of current production unless specified otherwise. Equipment not specified in the Contract Documents shall be suitable for the intended use and shall be subject to approval by the Engineer.
- B. All equipment, products and materials shall be free of defects and shall be constructed to operate in a safe manner without excessive noise, vibration, leakage, or wear.
- C. All equipment shall bear the inspection label of Underwriters Laboratories Inc.
- D. All equipment and material for similar applications or systems shall be provided from the same manufacturer unless noted otherwise.
- E. Cast iron soil pipe and fittings shall bear the collective trademark of the Cast Iron Soil Pipe Institute.

2.02. ELECTRICAL WORK

- A. Except as otherwise specified or noted, electrical equipment used for plumbing systems shall be as specified herein.
- B. Motor controls, system controls, starters, disconnects, pilot lights, push buttons, etc. shall be furnished by the Contractor compatible with the apparatus that it operates. Electrical equipment shall be wired for the voltage, as shown on the Electrical Drawings.
- C. The Contractor shall be responsible for coordinating and furnishing equipment of voltage shown on the electrical documents.
- D. Electric motors shall be high efficiency, open drip-proof type unless otherwise specified. Motors shall be standard NEMA continuous duty type and shall bear the UL Label. Motors shall be selected with a minimum of 15% safety factor greater than the fan brake/horsepower (e.g. 4.75BHP would require a nominal 7-1/2 HP motor). The motor service factor shall not be used as part of the safety factor. All motors shall have thermal overload protection. Motors shall meet Table MG-1-12C of EPACT 1992.
- E. Motors controlled by a variable frequency drive (VFD) shall be inverter duty rated and fully compatible with the VFD provided.
- F. Starters for motors 1/3 HP and smaller shall be manual type, and for 1/2 HP and larger, shall be magnetic type. Starters shall be minimum size 0, combination type (with disconnect and lockable handle) with molded case circuit breaker. Starters for motors with remote or automatic control shall be magnetic. Relays, interlocks and auxiliary contacts shall be provided as specified and required.
- G. Magnetic motor starters shall be across-the-line, full voltage, non-reversing type unless otherwise indicated on the Drawings or specified herein.
- H. Motor controls shall be either "Hand-Off-Auto" switches or "On-Off" push buttons with one indicating light. "Hand-Off-Auto" switches shall be provided for automatically controlled apparatus.
- I. Motor starters that are not an integral part of equipment shall be installed in conformance with Division 16 - Electrical Requirements.
- J. All "loose" disconnects and starters shall be installed by Division 16.
- K. Power wiring to disconnects, starters, and equipment shall be provided and installed by Division 16. All equipment requiring electrical power shall be provided with disconnect switches at each piece of equipment. Coordinate switch type (fused or non-fused) with equipment characteristics, manufacturer's recommendations and Electrical Drawings.

- L. The Contractor shall provide all system controls, control and interlock wiring 120 volts and less in conduits in accordance with materials and installation requirements of Electrical Section. All starters shall be labeled on face of starter.
- M. All starters for 3-phase equipment shall have overload devices in all three (3) phases.
- N. Wiring diagrams shall be furnished by the Contractor.
- O. Acceptable manufacturers shall be General Electric, Square D, Eaton, Siemens and Allen Bradley.

2.03. PIPING SYSTEMS

- A. General
 - 1. The various piping systems are classified as follows, and materials of construction shall be as specified unless otherwise noted on the Drawings.
 - 2. Piping, valves and equipment used in similar applications shall be provided from the same manufacturer unless noted otherwise.
- B. Domestic Water System Branch Piping, Underground, 2 Inches and Smaller, Suitable for a Working Pressure of 125 psig
 - 1. Piping Systems
 - a. Copper Type K, soft annealed, conforming to Federal Specification WWT-799. Joints and fittings are not permitted below floor slabs with copper Type K soft annealed pipe.
- C. Domestic Cold Water and Hot Water Systems Above Ground
 - 1. Piping Systems
 - a. Basis of Design
 - 1) Type "L" hard drawn copper tubing per ASTM B-88 and Federal Specification WWT-799. Fittings: Solder or brazed joint copper fittings per B16.18 or 16.22. Grooved copper fittings with full flow radius elbows, ASTM B-75, ASTM B-584, Victaulic CTS system, or Engineer approved equal. Copper pressed fittings with radius elbows, crimped connections and EPDM O- rings, ASTM B-88, 200 psi rating, Grinnell Fig. 640, Ridgid Viega ProPress, ProPress XL or Elkhart Xpress systems. Ductile iron mechanical couplings with bolted connection for grooved piping, ASTM A-536, with EPDM copper tube size gaskets, rated working pressure 300 psi. Joints: Soldered or brazed joints with lead-free brazing filler materials and compatible alloys.

- 2) Schedule 10 T304L stainless steel pipe, ASTM A312 (300 psi at 140 degrees F), Schedule 40 T304L stainless steel pipe, ASTM A312 (600 psi at 140 degrees F). Fittings: Schedule 10S/40S rolled groove 304 stainless steel fittings. Joints: Ductile iron or 316 stainless steel rigid grooved couplings, EPDM gasket, 316 stainless steel nuts and bolts. Victaulic Style 89, Anvil Figure 7400 (300 psi for 10S), Victaulic Style 489, Anvil Figure 7401 (600 psi for 40S).

D. Sanitary, Waste and Vent, Below Ground to 5'-0" Outside Building

1. Piping Systems

a. Basis of Design

- 1) Schedule 40 DWV PVC pipe, ASTM 1785. Install per ASTM D 2321. Fittings: Schedule 40 DWV PVC, socket type fittings, ASTM 2665. Joints: Solvent joints for PVC, ASTM D-2564. PVC piping is not acceptable for waste piping receiving discharge higher than 130 degrees F, cast iron piping is to be installed at the central plant, mechanical rooms and at all laundry.
- b. Single and double sanitary tee fittings are not allowed for the piping to any plumbing fixture; combination wye and eighth bend fittings shall be installed.
- c. Double combination fittings shall not be used for connections to horizontal drainage piping; single wye and eighth bend fittings shall be used for all connections.
- d. Foam core PVC piping is not acceptable for any drainage system.
- e. All cast iron pipe and fittings shall carry an NSF International listing.

E. Sanitary, Waste and Vent Systems Above Ground

1. Piping Systems

a. Basis of Design

- 1) Polyvinyl Chloride (PVC), schedule 40 DWV PVC pipe, ASTM 1785. Fittings: Schedule 40 DWV PVC, socket type fittings, ASTM 2665. Joints: Solvent joints for PVC, ASTM D-2564. PVC piping is not acceptable in plenum ceilings or for waste piping receiving waste discharge higher than 130 degrees F, such as from laundry and kitchen equipment.
- b. Single and double sanitary tee fittings are not allowed for the piping to any plumbing fixture; combination wye and eighth bend fittings shall be installed.

- c. Double combination fittings shall not be used for connections to horizontal drainage piping; single wye and eighth bend fittings shall be used for all connections.
- d. Foam core PVC piping is not acceptable for any drainage system.
- e. All cast iron pipe and fittings shall carry an NSF International listing.

F. Pumped Discharge Piping

1. Piping Systems

- a. Schedule 40 seamless or welded galvanized steel pipe, ASTM A-53. Fittings: Class 125 and 250, cast iron threaded fittings, ASTM A-126, ANSI B16.4. Ductile iron rigid grooved couplings, EPDM gasket, 316 stainless steel nuts and bolts. Victaulic Style 77 (1,000 psi).
- b. Type "L" hard drawn copper tubing per ASTM B-88 and Federal Specification WWT-799. Fittings: Solder or brazed joint copper fittings per B16.18 or 16.22.

2.04. VALVES, FLANGES AND UNIONS

A. General

- 1. All systems under this section shall be provided with valves to permit complete and sectional control of the system. They shall be located to permit easy operation, replacement and repair. They shall be installed where shown on the Drawings, or as herein specified. Valves shall be as manufactured by one of the following companies: American, Anvil International, FNW, Kennedy, Kitz, Milwaukee, Nibco, Powell, Stockham, Victaulic, Watts, or approved equal, and shall conform to description listed below.
- 2. Control valves shall be provided for the domestic hot and cold water supply to all risers and specific areas such as restrooms, fixture groups, equipment, hose bibbs and wall hydrants, food service areas and building separations. Valves shall be located in back-of-house or service areas with access panels or above lay-in ceilings. No access panels will be permitted in public spaces with gypsum ceilings. The tower riser control valves will be provided with an access panel concealed below the lowest guestroom vanity or above the ceiling in the closet in the lowest level unless specifically noted otherwise.

B. Valve Description

1. Gate Valves

- a. 2-1/2" and larger, Stockham G-634, 175 lb. flanged OS&Y.

- b. 2" and smaller, Milwaukee Fig. UP149, 125 lb., sweat connection. 2-1/2" and larger, Milwaukee Fig. F-2885, 125 lb., flanged or Milwaukee CW 223 Butterfly valve with 10 pos. lever handle.
 - c. 8" and larger, Milwaukee CW 323 Butterfly valve with gear operator.
 - d. 2-1/2" and smaller, Milwaukee No. BB-SC100, threaded.
- 2. Check Valves
 - a. 2" and smaller, Milwaukee Fig. UP509, 200 lb., threaded.
 - b. 2-1/2" and larger, Milwaukee Fig. F-2974, 125 lb. flanged.
 - c. 2-1/2" and larger, Stockham G-939, 175 lb. flange.
- 3. Ball Valves
 - a. 2" and smaller, Milwaukee UPBA 100.
- 4. Plug Valves (Natural/Propane Gas System)
 - a. 1/2" and larger, Rockwell Nordstrom Fig. 142 or 143 lubricated plug valve, threaded or flanged as required, wrench operated.
 - b. 1/2" through 2", two-piece full port brass ball valve, FM and AGA approved, Watts series FBV-3 or equal.
- 5. Balancing Valves (Hot Water Recirculation)
 - a. Ball valves are not acceptable for balancing the hot water return system.
- 6. Backflow Preventers
 - a. Backflow preventers shall be installed at all locations required by code and local authorities, at all connections to mechanical equipment, and elsewhere as shown on the Drawings. Backflow preventers shall be reduced pressure principle type and shall be a complete assembly including tight-closing shutoff valves before and after the device. The design shall include test cocks and a pressure-differential relief seating check valves. The device shall meet the requirements of and be certified by ASSE Standard 1013, AWWA Standard C-506, and USC Foundation for Cross-Connection Control. A strainer shall be located upstream of the device. Route relief outlet from cone receptor to an air gap fitting for discharge to sanitary sewer.
 - b. Acceptable manufacturers are Ames Company, Apollo Valves, Hersey Products, Watts Regulator, and Zurn-Wilkins.

7. Class II turbine type water meters shall be installed downstream of the backflow preventer, on the domestic water supply to HVAC equipment make-up, irrigation supply, and pool/fountain supply to allow for a reduction in sewer rate charges.
8. Pressure Reducing Valves
 - a. A duplex pressure reducing valve station shall be provided on all domestic water systems greater than 80 psi.
9. Flanges
 - a. All flanges shall be faced and drilled for not less than 125 pounds steam working pressure complete with necessary adapter, and shall be of size and material of adjacent piping. All flanges shall be faced (raised or flat) to be compatible with connecting valves, equipment, etc. The connection of one raised face flange to a flat face flange shall not be permitted.
10. Unions and Joints
 - a. Unions on drainage pipes on fixture side of traps may be slip or flanged joints with soft rubber washers or gaskets. Unions 2" and smaller on copper pipe shall be all brass with ground joint and shall be 250# copper to copper. Unions above 2" shall be flanged with gaskets. Provide union at water and gas connection to all equipment, except plumbing fixtures.

2.05. CLEANOUTS

- A. Cleanouts shall be provided where indicated on Drawings and elsewhere as required by code.
 1. Cleanouts in pipelines shall consist of cast iron ferrule and heavy duty cleanout plug with square head as scheduled on the Drawings. Where piping is concealed in floors or walls cleanouts shall be installed in or near surface of floor or walls and have countersunk plugs with covers.
- B. Cleanouts shall be provided at the base of the stack on all sanitary, waste and drainage stacks. Base of stack cleanouts on piping located within walls or partitions shall be cast iron cleanout tee with countersunk plug and chromium-plated round access cover, J.R. Smith figure 4530 or approved equal.
- C. Brass cleanouts shall be solid nut construction.
- D. Provide Owner with three (3) wrenches for removing flush cleanout plugs.

2.06. FLOOR DRAINS

A. Setting Grades

1. The plumbing contractor shall obtain exact elevation of finished grade at the top of the drains prior to setting any drains. Drains installed in excess of 1/4" below the adjacent finished floor shall be removed and reset to the correct elevation.

B. Drain Types

1. All floor drain outlets shall be of size noted on the Drawings. All drains shall be equal to the assembly specified. Acceptable manufacturers are as follows: Josam Co., Zurn Co., J.R. Smith Co., Wade, or approved equal. Drains shall be acid-resisting where indicated.
2. Floor drains noted for use in public spaces such as Restrooms, Locker Rooms, Showers, etc., shall be general purpose type. Drains shall be cast iron with 6" square nickel bronze strainer and trap primer connection. Drains shall be Jay R. Smith Figure 2005B-L-B6-P050 or approved equal.
3. Floor drains noted for use in mechanical rooms shall be heavy duty type. Drains shall be cast iron shallow type, 12" diameter with ductile iron tractor grate, sediment bucket, and trap primer connection. Secured funnels shall be provided on all drains receiving condensate discharge to eliminate overflow or spillage. Drains shall be Jay R. Smith Figure 2141 series or approved equal. Drains located within rooms considered to be a plenum are to be provided with a deep seal trap and trap primer.
4. Floor sinks shall be cast iron with acid resistant coating, 12" square x 8" deep, aluminum or cast iron dome bottom strainer (plastic strainers are not acceptable), nickel bronze half or three-quarter grate as required by the equipment served. The solid portion of the grate shall be located to the front of the equipment; the open section of the grate shall be located at the rear of the equipment for receipt of the indirect waste. Floor sinks shall be Jay R. Smith figure 3430 series.
5. Floor or hub drains located within rooms considered to be a plenum are to be provided with a deep seal trap and trap primer.
6. Unless otherwise noted, acceptable manufacturers shall be Josam, Jay R. Smith, Mifab, Watts, and Zurn.

C. Trap Primers

1. Drains not receiving a continuous discharge are to be provided with an automatic trap primer.

2. Trap primers shall be in-line type actuated by flow independent of pressure, pressure activated primers are not acceptable. Josam models 88250 and 88300.

2.07. ACCESS PANELS

- A. Group valves together above suspended ceilings, walls, furred spaces to minimize the number of access panels, but with all valves freely accessible for maintenance. Locate all valves within 1'-0" of access point.
- B. Furnish access panels of proper size to service concealed valves and cleanouts. Panels shall be of the proper type for material in which they occur and are to be furnished by the Contractor, but installed by the particular trade for the material within which the access panel is installed.
- C. Panels shall have flush doors with No.14 USCG steel door and trim No. 16 USCG steel frame, metal wings for keying into construction, concealed hinges, and screwdriver operated stainless steel cam lock. Panels shall be shop coated with one coat of zinc chromate primer. Valves above removable ceilings shall have tile clips by the Contractor for identification.
- D. Access panels are not allowed in gypsum ceilings in public spaces.

2.08. INSULATION

- A. The following shall be insulated:
 1. All domestic cold water piping above grade except at horizontal chase branch piping to individual plumbing fixtures.
 2. All hot water and hot water return piping except at horizontal chase branch piping to individual plumbing fixtures.
 3. All horizontal and vertical storm drain piping and roof drain bodies.
- B. Domestic hot, cold, hot water recirculation, primary storm drainage, and waste drainage piping shall be insulated with 4 lb. density sectional fiberglass insulation with a thermal conductivity not to exceed 0.24 with white all service jacket and vapor barrier. All joints and seams shall be sealed vapor tight. All seams and staples shall then be covered with "All Service Jacket" three-inch wide tape.

- C. Materials as specified in this section shall be manufactured by CertainTeed, Johns Manville, Knauf, Owens Corning or equal. Insulation thicknesses shall be as shown in the following table:

Minimum Pipe Insulation			Insulation Thickness for Pipe Sizes				
Piping System Types	Fluid Temperature Range		1 in. and Less	1-1/4 to 2 in.	2-1/2 to 4 in.	5 and 6 in.	8 in. and Larger
	°C	°F	In.	In.	In.	In.	In.
PLUMBING							
Domestic Water	Ambient	Ambient	0.5	1.0	1.0	1.0	--
Domestic Hot Water and Hot Water Recirculation	43-71	110-160	1.0	1.0	1.5	1.5	--
Above Grade Drains and Piping Receiving Condensate or Ice Machine Discharge	4.5-15.5	40-60	0.5	1.0	1.0	1.5	--

2.09. PIPE SUPPORTS AND HANGERS

- A. All piping shall be supported by means of hanger rods and pipe hangers from roof or floor structure using supplementary steel and/or lagbolts. Water supply pipe connecting to pumps, equipment, fixtures or fixture supplies shall be made rigid at the connection point.
1. Piping shall be supported from new concrete construction with Anvil International Fig. 282 inserts or drilled expansion anchors.
 2. Piping shall be supported from new steel construction with Anvil International Fig. 131 beam clamp, Fig. 61 beam clamp, Fig. 66 welded beam attachment or Fig. 60 washer plate with all-thread rod.
 3. Piping and brackets shall be supported from hollow block construction using drilled masonry holes and cadmium plated toggle bolts.
 4. Piping shall be supported from wood truss construction with plated lag screws or bolts, B-3227 and B-3228.
 5. Pipe supports shall not be attached to floor or roof deck.
 6. Acceptable manufacturers are: Anvil, B-Line and FNW.

- B. Unless otherwise noted, hangers and clamps shall be as listed below (all model numbers are B-Line Systems):
 - 1. Cast iron/steel pipe - B3100 or B3109.
 - 2. Insulated water pipe - B3100 or B3109 with B3151 placed over insulation protection saddle.
 - 3. Uninsulated bare copper pipe - B3170 CTC plastic coated.
 - 4. All supports and mounting hardware are to be galvanized, cadmium plated, or factory enamel painted.
 - 5. All supports on insulated piping systems shall be sized to fit outside the insulation and shall be provided with insulation inserts and shields at each hanger or support point.
- C. Branch piping to fixtures in chases shall be supported with plastic or copper clamp type supports:
 - 1. B-Line Ruffin series.
 - 2. Holdrite Systems.
- D. Maximum spacing between pipe hangers shall be:
 - 1. Steel pipe
 - a. 1-1/4" and smaller: 6'-0"
 - b. 1-1/2" – 2": 8'-0"
 - c. 2-1/2" and larger: 10'-0"
 - 2. Cast iron soil pipe: 2" and larger: 10'-0"
 - 3. Copper tubing:
 - a. 1/2" – 1-1/4": 5'-0"
 - b. 1-1/2" – 2": 8'-0"
 - c. 2-1/2" and larger: 10'-0"
 - 4. PVC/CPVC and all plastic pipe:
 - a. 1-1/4" and smaller: 3'-0"
 - b. 1-1/2" and larger: 4'-0"
- E. At least one hanger shall occur within 2'-0" from where change in direction takes place. Where pipes extend down or up to other floors, pipe clamps shall be provided on each floor to support vertical risers. Vertical piping drops shall

be rigidly anchored to structure at the top and bottom offsets and at eight foot increments along the vertical drop.

- F. Special approved hangers that require less installation space are to be used where required due to ceiling space limitations.
- G. All connections to pumps and other vibrating machinery shall be provided with stainless steel braided flexible hose connections. Connections to potable water systems shall meet ANSI/NSF 61 design standards.
- H. Lateral bracing shall be provided at all pipe turns to prevent movement.

2.10. WATER HEATERS – ELECTRIC

- A. Provide electric storage and tankless type water heaters as specified on the Drawings.
- B. Water heater shall carry a UL certification for 150 psi working pressure, an ASME temperature and pressure relief valve (T and P) sized for the heater, vacuum relief valve, immersion thermostat, glass lined tank, temperature gauge on outlet, and manual reset high limit control.
- C. Provide a metal drain pan and 3" high concrete housekeeping pad at each water heater. Water heaters greater than 10 gallons shall be floor mounted.
- D. Provide a combination ball/relief valve on the domestic water supply sized as indicated on the Drawings, Watts series BRV or approved equal.
- E. The water heater shall carry a five-year minimum limited warranty for tank leakage.
- F. Electric water heaters shall be as manufactured by:
 - 1. A.O. Smith
 - 2. Bradford White
 - 3. Lochinvar
 - 4. State

2.11. FLASHING

- A. Vent pipes passing through roof shall be flashed watertight.
- B. The roof connections shall meet the approval of the manufacturer of the roofing materials and shall comply with the roof bond requirements.

2.12. FLOOR, WALL AND CEILING PLATES

- A. Furnish and install heavy gauge chromium plated steel wall and ceiling plates on all exposed pipes in finished areas where they pass through walls, ceilings, etc. Plates shall be of type that will remain permanently in position

and where pipes are insulated they shall be of size necessary to cover insulated pipe.

2.13. GALVANIC PROTECTION

- A. Insulate joints between dissimilar metals with suitable isolation gasket and bolts with fiber ferrules and washers and/or suitable armored insulation fittings by Clearflow, Crane, Capital, or Epco, so there will be no contact between the metals or with insulating bushings.

2.14. PIPING SYSTEMS IDENTIFICATION

- A. A marker showing the service and an arrow indicating the direction of flow shall be applied on all of the following piping systems applicable to the project installed under this section of the Specifications:
 - 1. Domestic hot, cold and hot water recirculation water piping
 - 2. Gas piping
 - 3. Sanitary, waste and vent piping
- B. Piping identification shall be applied on all piping systems in areas of exposed construction and in areas with accessible or lay-in ceilings. The piping shall be labeled at each wall and floor penetration (both sides), and at connections to equipment. In addition, straight runs of piping shall be labeled at intervals not greater than 25 feet.
- C. The letter size and background color shall conform to the Identification of Pipe System ANSI A-13-1. The vinyl plastic markers shall be as manufactured by Seton Name-Plate Company, W. H. Brady Company, or Westline products.
- D. Each valve in the Plumbing and Fire Protection systems is to be provided with an individually numbered valve tag.
- E. Valve tags are to be brass or plastic laminate, 1-1/2" minimum diameter with brass chain and hook for securing to the valve.
- F. Valve tags will include a "P" or "FP" lettering designation to indicate the appropriate system. Numbering shall be consecutive for each service of either the Plumbing or Fire Protection systems.
- G. A printed list or schematic drawing shall be compiled for each system indicating the location and detailed description of the system or equipment served.
- H. One copy of each list shall be framed and mounted at the location designated by the Owner. An additional copy of each list is to be included in the Operations and Maintenance Manual.

2.15. EQUIPMENT LABELING

- A. All equipment shall be labeled. This shall include all pumps, water heaters, storage tanks, and other similar equipment.
- B. Equipment labeling shall be one of the following, unless noted or specified otherwise.
 - 1. Permanently attached plastic laminate signs with 1" high lettering.
 - 2. Stencil painted identification, 2" high letters, with standard fiberboard stencils and standard black (or other appropriate color) exterior stencil enamel.

PART 3 EXECUTION

3.01. GENERAL REQUIREMENTS

- A. All equipment and materials shall be completely installed, adjusted, and fully operational with all accessories and connections.
- B. Equipment, piping, etc. shall fit into the spaces provided in the building and shall be installed at such times and in such a manner as to avoid damage and as required by the job progress. The Contractor shall coordinate work with other trades and locate work described herein to avoid interferences with structural, electrical and architectural work. Equipment, accessories and similar items requiring normal servicing or maintenance shall be accessible.
- C. The Engineer and Owner's rep reserves the right to direct the removal of any item which, in his opinion, does not present an orderly and reasonably neat or workmanlike appearance. Such removal and replacement shall be done when directed by the Engineer and without additional cost to the Owner.
- D. Mounting heights, unless otherwise noted, are to the finished bottom of the device.

3.02. EXCAVATION, TRENCHING AND BACKFILLING

- A. The Contractor shall perform all excavation to install the work herein specified and as indicated on the Drawings. During excavation, material for backfilling shall be piled back from the banks of the trench to avoid overloading and to prevent slides and cave-ins. All excavated materials not to be used for backfill shall be removed and disposed of by the Contractor. Grading shall be done to prevent surface water from flowing into trenches and others excavation and any water accumulating therein shall be removed by pumping. All excavation shall be made by open cut. No tunneling or boring shall be done except under pavement.

- B. The bottom of the trenches shall be graded to provide uniform bearing and support for piping on undisturbed soil at every point along its entire length. Overdepths shall be backfilled with loose, granular, moist earth, and tamped in 12" layers. Remove unstable soil that is not capable of supporting equipment or installation and replace with specified material for a minimum of 12" below invert of equipment or installation.
- C. The trenches shall be backfilled with the excavated materials approved for backfilling, consisting of structural soil, engineered fill, sand and gravel or soft shale, free from large clods of earth and stones, deposited in 6" layers and tamped until the crown of the pipe is covered by a minimum of 6" of tamped earth. The backfill under and beside the pipe shall be compacted for pipe support. Backfill shall be brought up evenly on both sides of the pipe so that the pipe remains aligned. In instances where the manufacturer's installation instructions for materials are more restrictive than those prescribed by the code, the material shall be installed in accordance with the more restrictive requirement. The backfilling shall be carried on simultaneously on both sides of the trench so that injurious pressures do not occur. The compaction of the filled trench shall be at least equal to 95% of the maximum density as determined by the Standard Proctor Test. Settling the backfill with water will not be permitted. Reopen any trenches not meeting compaction requirements or where settlement occurs, refill, compact, and restore the surface to the grade and compaction indicated, mounded over and smoothed off. A metallic lined underground warning tape shall be provided 12" below finished grade. The tape shall be identified as to the type of line per ANSI standard nomenclature and color.
- D. Provide a layer of sand at least 6" deep under all plastic pipe installed in soil. Bell holes shall be excavated to ensure that the sewer pipe rests for its entire length upon a solid trench bottom.
- E. Perform excavation and backfilling work in accordance with applicable portions of the earthwork section.

3.03. STORAGE AND PROTECTION OF MATERIALS

- A. During construction, all equipment shall be properly protected against damage, defacing and freezing with shipping cartons, plastic sheeting, shipping covers, etc.
- B. All open ends of piping and equipment shall be sealed with nipples and caps, plugs, test plugs until final connection to system is made.
- C. All equipment and piping shall be protected to prevent entrance of foreign matter and debris by covering exposed openings during construction.

- D. Handle and store materials in accordance with manufacturer's and supplier's recommendations and in manner to prevent damage to materials during storage and handling. Replace damaged materials.
- E. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable to protect the equipment or materials. Equipment or materials damaged or which are subjected to these elements are unacceptable and shall be removed from the premises and replaced.

3.04. CUTTING AND PATCHING

- A. Work shall include all cutting, patching, concrete masonry and carpentry required as part of the equipment installation when not provided by other sections of these specifications.
- B. All work shall be performed as specified under architectural specification section for cutting and patching.

3.05. CONCRETE WORK

- A. Construct curbs, pads, vaults and similar supports for equipment where required.
- B. Provide 4" thick housekeeping pads at floor mounted equipment a minimum of 3" larger than the entire area occupied by equipment. Dowel pads to structural slab.
- C. Perform concrete work in accordance with applicable portions of Concrete sections. Minimum compressive strength of concrete shall be same as specified for slabs on grade.

3.06. CLEANING

- A. At all times, the premises shall be kept reasonably clean and free of undue amounts of waste, trash and debris by periodic cleaning and removal. After completion, all foreign material, trash and other debris shall be removed from the job site.
- B. After all equipment has been installed, but prior to testing, all equipment, piping, etc. shall be thoroughly cleaned both inside and out.
- C. After testing of systems as specified and just prior to Owner review and acceptance, all systems shall be finally cleaned and shall be left ready for use.
- D. Ream/rout all sanitary lines.

3.07. PAINTING

- A. Painting, except as otherwise specified, will be done under another section of the specifications, but the Contractor shall leave all surfaces of work free of rust, dirt and grease.
- B. The Contractor shall touch-up to match original finish any equipment scratched in shipment or installation. Touch-up painting of plumbing equipment shall be part of the plumbing work.
- C. Provide one coat of rust preventive primer on all new structural steel supports and new ferrous surfaces which are not galvanized (this includes piping systems). Rust preventative painting shall be part of the plumbing work.
- D. All painting and coating shall match the original and shall conform to the requirements detailed in other sections of these specifications. Do not paint over nameplates on equipment, nonferrous hardware, accessories or trim.

3.08. EQUIPMENT SUPPORT

- A. Major equipment supports (framed structural openings, etc.) shall be furnished and installed by others as shown on the Drawings. The plumbing work shall include, the furnishings and installation of all miscellaneous equipment supports, structural members, rods, clamps and hangers required to provide adequate support of all equipment.
- B. Unless otherwise shown on the Drawings, all equipment, piping, and accessories shall be installed level, square, and plumb.
- C. All equipment, piping, etc. supported by structural joists shall be supported by the top chord only of such joists. Hangers shall not be attached to the bottom chord of any joists or the roof deck.

3.09. PIPE PENETRATIONS

- A. Sleeves shall be installed in all masonry or concrete walls, floors, roofs, etc. for pipe penetrations. Sleeves for pipe shall be Schedule 40 black steel. Sleeves shall be sized to provide a minimum of 1/4" clearance between the sleeve and pipe.
- B. The 1/4" minimum clearance shall be provided between the sleeve and the insulation on insulated piping systems. A gap of the insulation shall be omitted at each side of a rated wall penetration to allow for the required fire stopping.
- C. As far as possible, all pipe penetrations shall be provided for at the time of masonry or concrete construction. Where drilling is required, only core drills shall be used. Star drills shall not be used.

- D. All pipes penetrating walls or floors of any construction shall be installed with escutcheon plates on both sides of the penetration securely fastened to the wall or floor. In exposed areas, escutcheon plates shall be chrome plated. All escutcheon plates shall be sized to completely conceal the penetration.
- E. Pipe penetrations through exterior walls shall be sealed watertight with expandable link type seals by Thunderline, Linkseal or Engineer approved equal.
- F. All pipe and duct penetrations of fire, smoke, or fire and smoke-rated assemblies shall be fire-stopped as required to retain the integrity of the UL rated assembly. Fire barrier products shall be as manufactured by Tremco, Hilti, 3M, Metacaulk, Nelson, or approved equal.

3.10. FLASHING

- A. All piping penetrating roofs shall be flashed in an approved manner, shall be watertight, and shall conform to the requirements detailed in other sections of these specifications.
- B. Flashing for piping shall be per roof manufacturer's published installation recommendations.

3.11. PIPING SYSTEMS

- A. Water Piping - General
 - 1. Pipe used in piping assembly must be clean of dirt and obstructions and shall have ends square and reamed before putting into the fittings.
 - 2. All piping must be true and plumb with proper pitch for draining of the soldering.
 - 3. All domestic water lines serving flush valve fixtures and washing machines shall be protected from water hammer by shock absorbers. Where shock absorbers are required they shall be as manufactured by Josam Mfg. Company, J. R. Smith, Sioux Chief Ind., Precision Plumbing or Zurn Mfg. Co. and shall conform to the Plumbing and Drainage Institute published requirements.
 - 4. All connections to water heaters, tanks and equipment shall be made with unions or flanges. Insulated piping systems shall be installed to provide space for insulation.
- B. Sanitary Waste, Vent, and Indirect Waste Piping - General
 - 1. Pipes shall be plumb and parallel to building walls, beams and columns unless otherwise indicated. All horizontal lines are to be evenly pitched and properly secured with iron or steel hangers, unless noted otherwise. A

pitch of 1/4 inch per lineal foot shall be maintained on all soil, and waste lines, wherever possible. Where long runs of piping require less pitch due to space restrictions, a less pitch shall be allowed on main lines four (4) inches and over in size, but in no event should any pipeline have a slope less than 1/8 inch per foot.

2. All soil and waste pipes shall be extended out full size through the roof or connected to a common vent as shown on the Drawings.
 3. Main vent stacks shall run parallel to the soil pipe stacks and shall connect to the vent continuation of the soil stack at least three (3) feet above the rim of the highest plumbing fixtures on the stack. Vent stacks shall also be connected at the base or horizontal offset of the soil stack through a Y and 1/8 bend or an upright Y fittings. Offsets in vent pipe shall be made with 45 degree fittings wherever possible. Horizontal vent lines shall pitch toward the waste line.
 4. Threaded joints shall have American National taper screw thread with graphite and oil compound applied to the male threads.
 5. Sanitary and vent stacks are to be run straight and plumb and all offsets shall be made at an angle of not less than 45 degrees.
- C. Mounting heights, unless otherwise noted, are to the centerline of the equipment and/or device.

3.12. TESTING OF PIPING SYSTEMS

A. General

1. All piping systems shall be subjected, before being insulated or concealed, to testing with water or air as noted and shall hold tight at the pressure head stated for the time interval required without adding air or water. While any system is being tested required head or pressure shall be maintained until all joints are inspected.
2. All tests shall be witnessed by the inspector having jurisdiction and the Owner's Representative, with a minimum 48-hour notice given these authorities.
3. All equipment, material, labor and testing mediums required for testing any of the various systems or any part thereof shall be furnished by the Contractor.
4. All connected equipment, accessories, etc. shall be isolated from piping systems prior to testing.

B. Sanitary Piping Systems

1. Water test shall be applied to these drainage systems either in their entirety or in sections as required, after rough piping has been installed. If the system is tested in sections, each opening shall be tightly closed except the highest opening in the section under test. All sections shall be tested with a minimum of 10 feet of head. In testing successive sections, at least the upper 10 feet of the next section shall be tested so that no joint of piping in the building shall be submitted to a test of less than 10 feet of head. The water shall be kept in the system for at least 30 minutes before inspection starts; the system shall then be made tight at all points.
2. Any points of the drainage systems to be tested with air instead of water shall be made by attaching an air compressor testing apparatus to any suitable opening and after closing all other inlets or outlets, forcing air into the system until there is a minimum gauge pressure of 5 psi. This pressure shall be held without the introduction of additional air for a period of at least 30 minutes.
3. Exterior connections shall be tested as part of the interior systems.

C. Interior Water Piping Systems

1. Upon completion of the entire water supply system or a section of it as required, it shall be tested prior to connection of fixtures and proved tight under a water/air pressure of 150 psi. Pressure shall hold for a period of one hour without introducing additional water/air. Water used for testing shall be from a potable source of supply. Defective joints or piping shall be replaced as required and all piping shall be retested.

D. Defective Work

1. If inspection or tests show defects, such defective work or material shall be replaced and inspection and tests shall be repeated. All repairs to piping shall be made with new material. Caulking of screwed joints or holes is not acceptable.

E. Additional Tests

1. Provide all additional tests such as smoke or pressure tests as required by the regulations or as directed by authorities making the inspection.
2. Provide for any repeated test as directed by the Owner's Representative, to make all systems tight as required.
3. Visual inspections of joints, valves, etc. shall be made as directed by the Engineer or the Owner's representative.

3.13. DISINFECTION OF WATER SYSTEM – INTERIOR

- A. Prior to project completion, all potable water piping systems shall be disinfected per local code requirements.
- B. Whenever the authority having jurisdiction does not specify disinfection procedures, the new water piping system shall be thoroughly disinfected with a solution containing not less than 50 parts per million of available chlorine. The chlorinating material shall be either liquid chlorine or sodium hydrochloride solution and shall be introduced into the system and drawn to all points in the system. The disinfection solution shall be allowed to remain in the system for a period of eight hours, during which period all valves and faucets shall be opened and closed several times. After disinfection, the solution shall be flushed from the system with clear water until the residual chlorine content is not greater than 0.2 parts per million.
- C. This work is to be supervised or performed by an approved chemical testing laboratory and results sent to Engineer or his representative for verification.

3.14. FIXTURE CONNECTIONS AND SUPPORTS

- A. Wall fixtures shall be hung by means of carrier type fixture supports as manufactured by J.R. Smith, Josam, Mifab, Wade or Zurn.

3.15. SLEEVES

- A. Furnish and install pipe sleeves around all piping passing through concrete masonry walls, floors, beams, etc. Sleeves shall be of such diameter as to allow pipe to pass through easily and permit expansion and contraction of pipe. Where pipes are insulated, the sleeves shall be of such diameter as to allow the insulated pipe to pass through easily. The sleeves shall be placed before the pouring of concrete and before construction of walls. Sleeves for vertical risers shall extend a minimum of 1" above the floor slab. Sleeves to outside walls below grade shall be caulked or provided with expansion type mechanical seals as required to make them waterproof.

3.16. INSTALLATION OF UNIONS

- A. Unions shall be located as shown on plans and as required by equipment so piping and equipment can be easily dismantled. Unions shall not be installed in any location where they are not readily accessible.

3.17. TRAPS

- A. All fixtures, drains, etc. shall be provided with traps, unless specifically shown or specified otherwise. Traps shall be set in an upright position, level and true, and shall be vented as shown and required. All exposed traps shall be provided with cleanout plugs.

3.18. CLEANOUT INSTALLATION

- A. Furnish and install cleanouts in soil and waste lines as required by Code and/or job conditions, as shown on the Drawings and as follows: At or near the end of each branch and main drainage line, horizontal lines at intervals as required by code. All cleanouts shall be readily accessible, with plugs easily removable for cleanout lines. Cleanouts at the base of vertical piping shall be held within 2'-0" from finished floor unless otherwise indicated. Cleanout locations shall be approved by the Owner's representative.

3.19. FLASHING INSTALLATION

- A. All pipes passing through roofs shall be flashed in an approved manner. Flashing shall be watertight.
- B. Roof connections shall meet the approval of the manufacturer of roofing material and shall comply with roof bond requirements.

3.20. EQUIPMENT AND MATERIAL PROTECTION

- A. During construction all equipment shall be properly protected against damage, defacing and freezing with shipping cartons, plastic sheeting, shipping covers.
- B. All open ends of piping and equipment shall be sealed with nipples and caps, plugs, test plugs until connection to system is made.

3.21. SPACE REQUIREMENTS

- A. Piping, apparatus and equipment shall fit into the space provided in the building or within the property and shall be installed at such time and in such manner as to avoid damage to the building structure or property as required by the job progress. Equipment, apparatus and accessories requiring normal servicing or maintenance shall be made easily accessible.

END OF SECTION 15400

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SECTION 15401
NATURAL GAS PIPING SYSTEM

PART 1 GENERAL

1.01. SYSTEM

- A. Provide a complete system of natural gas piping from gas meter to all natural gas burning equipment and appliances.
- B. All gas equipment specified herein shall be suitable for use with natural gas system.

1.02. DESIGN STANDARDS

- A. The natural gas system shall be designed and installed in accordance with the requirements of the following codes and standards:
 - 1. The North Carolina Gas Code, 2018 Edition
 - 2. NFPA 54 - National Fuel Gas Code

PART 2 PRODUCTS

2.01. PIPE AND FITTINGS

- A. Aboveground Piping
 - 1. Pipe sizes larger than 2 inches:
 - a. Schedule 40 black steel pipe, ASTM A53 with welded joints and standard weight black steel butt weld fittings, ASTM A234 or socket weld fittings, ASTM A105.
 - b. Schedule 40 black steel pipe, ASTM A53, with 150 pound steel slip- on welding flanges, ASTM A181, for connection to flanged valves and equipment.
 - 2. Pipe sizes 2 inches and smaller:
 - a. Schedule 40 black steel pipe, ASTM A53, with screwed joints and 150 pound threaded malleable iron fittings, ASME B.16.3.

2.02. JOINTS

- A. Threaded joints shall be made with a pipe compound specifically listed as resistant to reaction with gas and shall be applied to male threads only. After cutting and prior to threading, pipe shall be reamed and shall have burrs removed.

- B. Welded joints shall be fusion welded in accordance with the American Standards Code for pressure pipe, ASME B31.1, Section 6.
- C. Flanged joints shall be faced true, provided with ring type gasket, and made square and tight. Flanges shall have raised or flat faces to mate with adjacent flanges of valves.

2.03. UNIONS

- A. Unions in steel piping shall be 150 pound socket welded carbon steel conforming to ASME B.16.11 or class 150 malleable iron threaded fittings conforming to ASME B.16.3.

2.04. VALVES

- A. Valves 3" in size and larger shall be semi-steel plug valves with cast iron body, lubricated cast iron plug, flanged ends, and wrench operated for 175 pound WOG. Valve shall be Rockwell Nordstrom Fig. 143 or equal.
- B. Valves 2-1/2" in size and smaller shall have bronze body and plug, socket welded ends, and square head for 125 WOG. Valve shall be Crane or Fig. 250 or equal.
- C. Full port ball valves 2" in size and smaller shall have brass body with chrome plated brass ball with threaded or socket welded ends, 600 psi WOG, FM approval, AGA approval. Valve shall be Watts series FBV-3 or equal.
- D. Lubricated plug valves shall be lubricated at the factory and sealant shall be suitable for natural gas. Provide two valve wrenches for each type of valve specified.
- E. Acceptable valve manufacturers are Rockwell Nordstrom, Crane, FNW, Stockham, Powell, Walworth, or Milwaukee.

2.05. PRESSURE REGULATING VALVES

- A. Pressure regulator shall be cast iron, ductile iron or stainless steel, corrosion-resistant spring-loaded type with internal pressure relief, 175 psi working pressure. Provide threaded ends for piping 2" and smaller, flanged ends for piping 2-1/2" and larger. All regulator vents shall be extended to the exterior unless otherwise specified. Regulators equipped with and labeled for use with an approved vent-limiting device shall not require a vent to the exterior. Acceptable manufacturers are Fischer Regulators, Jordan Valve, Maxitrol, Rockwell and Sensus.
- B. Low pressure regulators supplied from medium and high pressure gas systems shall be lock-up type high gas pressure regulators and shall be installed a minimum of ten feet upstream of the equipment inlet connection.

- C. Where low pressure line regulators have inlet pressures exceeding 2 psi, a downstream over-pressure protection device (OPD) shall be installed in accordance with ANSI Z21.80.
- D. Medium pressure regulators shall have a capped tee fitting (sediment trap) upstream from the regulator and a capped tee fitting installed not less than 10 pipe diameters downstream of the regulator.

2.06. PIPE SUPPORTS & HANGERS

- A. All piping shall be supported by means of hanger rods and pipe hangers from roof or floor construction using supplementary steel and/or lagbolts.
 - 1. Piping shall be supported from new concrete construction with [Anvil International Fig. 282 inserts] [drilled expansion anchors].
 - 2. Piping shall be supported from new steel construction with Anvil International Fig. 131 beam clamp, Fig. 61 beam clamp, Fig. 66 welded beam attachment or Fig. 60 washer plate with all-thread rod.
 - 3. Piping and brackets shall be supported from hollow block construction using masonry drilled holes and toggle bolts.
 - 4. Piping shall be supported from wood truss construction with plated lag screws or bolts, B-3227 and B-3228.
- B. Unless otherwise noted, hangers and clamps shall be as listed below (all model numbers noted are B-Line Systems):
 - 1. Gas pipe – B3100 or B3109.
 - 2. All supports and mounting hardware are to be galvanized or cadmium plated.
- C. Maximum spacing between pipe hangers shall be:
 - 1. 1/2": 6'-0"
 - 2. 3/4"-1": 8'-0"
 - 3. 1-1/4" and larger: 10'-0"
- D. At least one hanger shall occur within two feet (2'-0") from where a change in direction takes place in the line. Where pipes extend down or up to other floors, pipe clamps shall be provided on each floor to support pipe. Equal manufacturers for hangers and clamps are B-Line Systems, Anvil International, Fee and Mason, PHD Manufacturing, or approved equal.
- E. Piping on roofs shall be supported every six feet on piping 1/2" size, eight feet on piping 3/4" – 1" size, and ten feet on piping 1-1/4" and larger, and at each

change in direction, with manufactured adjustable height stainless steel pipe stands with integral pipe roller guides or clevis hanger for securing horizontal piping. Pipe stands shall be secured to the roof per the roofing manufacturer's installation requirements. Pipe stands shall be Miro Industries Model 4-RAH Series or PPH Models PP10 or PS-1-2.

- F. Pipe supports for rooftop gas piping may be painted fabricated steel pipe stands with integral pipe guides if approved by the roofing manufacturer.

PART 3 EXECUTION

3.01. INSTALLATION

- A. All interior gas systems shall be bonded to the building's grounding system per the requirements of NEC Section 250. A written statement bearing the names and signatures of the plumbing and electrical contractors indicating compliance with the NEC grounding requirements is to be submitted prior to project close-out.
- B. A valved union shall be provided at each connection to a piece of equipment. Equipment provided with a flanged inlet shall have a flanged connection.
- C. All valves installed in horizontal lines shall be installed with the stems horizontal or above.
- D. All gas piping shall be graded at the maximum slope available to prevent traps. All horizontal lines shall slope to risers and from the risers to the meter or appliance.
- E. Drip legs, 6" long, shall be provided in gas piping at ends of horizontal runs, at the base of risers, and at connections to equipment.
- F. Provide pressure regulators at all required connections to equipment; regulators shall be provided at the pressure required by the equipment served. Extend all pressure regulator vents individually to the exterior per local code authority requirements.
- G. Branch piping shall be taken off the top or sides of horizontal lines, but not from the bottom.
- H. Changes in pipe size shall be made with reducing fittings. No bushings will be allowed.
- I. No gas piping shall be placed underground inside the building.
- J. All interior and exterior ferrous metal gas piping, fittings and supports shall be primed and painted with two (2) coats of exterior grade enamel paint unless galvanized. The paint color shall be OSHA safety yellow unless visible from exterior elevations. If visible, paint to match adjacent wall surfaces.

- K. Piping shall be identified per 15400.2.14.

3.02. TESTING

- A. All piping is to be inspected and purged per the requirements of NFPA 54 and the local authorities' requirements.
- B. The entire gas piping system shall be tested with compressed air to 100 psi for a period of two (2) hours.
- C. Defective joints or piping shall be replaced as required and the system shall then be re-tested.

END OF SECTION 15401

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SECTION 15405

SUBMERSIBLE SEWAGE GRINDER STATION

PART 1 GENERAL

1.01. GENERAL REQUIREMENTS

- A. General Conditions: Refer to the General Conditions, the Supplementary General Conditions and the Special Conditions, all provisions of which apply to work under this section as if written in full herein.
- B. The scope of work described in these Specifications and/or indicated on the Drawings shall include the furnishing of all materials, equipment, appurtenances, accessories, connections, labor, etc. required for the installation of the submersible sewage ejector lift station.

1.02. DESIGN STANDARDS

- A. The submersible sewage grinder lift station assembly shall be designed and installed in accordance with the requirements of the following codes, standards and design guides:
 - 1. The North Carolina Plumbing Code, 2018 Edition
 - 2. The North Carolina Building Code, 2018 Edition
 - 3. UL Listing - All motors, controllers and electrical components shall carry a UL Approval for the assembly.
 - 4. NEMA Compliance - All controllers shall be designed in accordance with the specified NEMA requirements.

1.03. SUBMITTALS

- A. Shop Drawings and Catalog Data
 - 1. The Contractor shall prepare, submit, and obtain Engineer's review of manufacturers' shop drawings on the following equipment and systems prior to ordering, purchasing, or installation of any equipment or materials. All required submittals shall be transmitted simultaneously in hard ring binders (or electronic) with the associated specification section and the item submitted clearly identified. Partial submittals will be returned without review.
 - a. Submersible sewage grinder pumps
 - b. Slide rail disconnect assembly
 - c. Level control mechanical floats
 - d. Duplex pump controller with alternator

- e. Remote high level alarm panel
- 2. Review of shop drawings by the Engineer does not relieve the Contractor from the responsibility for complying with all requirements of the Contract Documents. Furthermore, it shall be the responsibility of the Contractor to coordinate the requirements of all approved equipment with other trades and disciplines such as vault construction, pipe connection points, electrical characteristics, etc. Such coordination shall be clearly indicated on the shop drawings.
- 3. Shop drawings shall clearly indicate selection of model numbers, sizes, dimensions, electrical characteristics, etc. of the proposed equipment. Any deviations from specified equipment shall be clearly indicated.
- 4. Submittal shall include pump curves with selection point clearly identified and wiring diagrams for all electrical components.

PART 2 PRODUCTS

2.01. SUBMERSIBLE GRINDER STATION

- A. The Contractor shall provide and install a complete *duplex* [~~triplex~~] submersible sewage ejector pump assembly of the capacity and size as scheduled on the Drawings.
- B. Pumps shall be centrifugal non-clog, cast iron shell and volute case with ductile iron impeller, stainless steel shaft and fasteners bronze wear ring, ceramic mechanical seal, horizontal discharge with quick disconnect slide rail system.
- C. Motors shall be sealed submersible type, oil filled housing (air filled housing will not be accepted), integral heat sensor thermostat with automatic reset.
- D. Seal leak probe with remote warning.
- E. Quick disconnect slide rail assembly complete with cast iron discharge elbow, sealing plate, stainless steel pump guide, all stainless steel fasteners and lifting chain. Rail assembly shall allow removal of the pumps without entering the storage basin.
- F. Double sealed power and control cable.
- G. Pumps shall be capable of passing a 2" solid.

2.02. PUMP CONTROLS

- A. Pump operation shall be controlled by a minimum of four mercury tube float switches in polypropylene housing. Float switches shall be mounted from a stainless steel bracket and support pole.

- B. Float switches shall control the following functions:
 - 1. Pumps off
 - 2. Lead pump on
 - 3. Lag pump(s) on
 - 4. High level alarm
- C. Pump assembly shall be furnished with a duplex NEMA 4X galvanized steel, lockable controller with battery backup, including the following components for each pump:
 - 1. Hand-off-auto switch
 - 2. Fused disconnect switch
 - 3. Magnetic starter with overload relay
 - 4. Control circuit transformer
 - 5. Pump operation light
 - 6. Power failure
 - 7. High water alarm
 - 8. Alarm horn with test and reset buttons
 - 9. Additional contacts (two minimum) and panel for remote alarm. Alarm panel to provide visual and audible notification, Myers model RA-11 or Engineer approved equal.
 - 10. Controller shall provide alternation of each pump after each operation.
- D. Liquid level sensing probes with the compatible controller are acceptable in lieu of mechanical float switches.
- E. Acceptable manufacturers in compliance with the specified requirements:
 - 1. Liberty Pump, Omnivore or equal

PART 3 EXECUTION

3.01. INSTALLATION

- A. Install submersible pump assembly, guide rail system and controls in accordance with the manufacturer's requirements.
- B. Provide a non-slam check valve in the discharge piping of each pump.

- C. Align and test pumps in accordance with manufacturer's instructions prior to start up.

END OF SECTION 15405

SECTION 15450
PLUMBING FIXTURES

PART 1 GENERAL

1.01. GENERAL REQUIREMENTS

- A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 15400 - Plumbing General.

1.02. WORK INCLUDED

- A. Receipt, unloading, handling, proper storage and protection from damage of all materials.
- B. Layout and coordination of work with other trades.
- C. The work under this section shall include all labor, materials, accessories, services, and equipment necessary to furnish and install the plumbing fixtures, trim and supports, complete as indicated on the Drawings and as specified herein.

PART 2 PRODUCTS

2.01. GENERAL

- A. All fixtures shall be white, unless otherwise indicated.
- B. All water closets shall have fully glazed trapways.
- C. All exposed trim to be heavy polished chrome plated brass, unless otherwise indicated. Chrome plated escutcheons are to be provided on all exposed fixture supplies and waste lines, including lavatory vanities.
- D. Electric water coolers shall be ARI Certified and shall carry a UL Listing. Units shall use refrigerant which is approved for use without ozone depleting properties. All waterway components are to be certified as lead free.
- E. All sinks and lavatories for use by the handicapped shall have manufactured insulation shields on all supplies and P-traps per ADA requirements unless the vanities are provided with ADA compliant shrouds.
- F. All exposed plumbing fixture items such as faucets and flush valves shall be provided with vandalproof trim.

2.02. CLEANOUTS

- A. Cleanouts on exposed piping in unfinished areas shall be heavy duty cast iron with countersunk plug. Cleanouts shall be Jay R. Smith Figure 4220 or approved equal.
- B. Cleanouts installed behind walls in finished areas shall be cast iron ferrule type for no-hub or service weight pipe with nickel bronze round frame and cover with securing screws. Cleanouts shall be Jay R. Smith Figure 4472T or approved equal.
- C. Cleanouts installed in concrete floors shall be cast iron type with gasket seal ABS plug round adjustable ductile iron cover with securing screw and Speedi-Set outlet connection. Cleanouts shall be Jay R. Smith Figure 4231L-M or approved equal.
- D. Cleanouts installed in tile floors shall be cast iron type with gasket seal ABS plug for easy removal, adjustable round nickel bronze top recessed for tile with securing screw and Speedi-Set outlet connection. Cleanouts shall be Jay R. Smith Figure 4151L or approved equal.
- E. Cleanouts installed in carpeted areas shall be cast iron type with gasket seal ABS plug, nickel bronze round frame and cover with carpet marker. Cleanouts shall be Jay R. Smith 4031-Y or approved equal.

2.03. PLUMBING FIXTURES

- A. The following is a list of acceptable manufacturers for the project:
 - 1. Fixtures: American Standard, Kohler, Toto and Zurn
 - 2. Faucets: American Standard, Chicago Faucets, Kohler, Moen, Speakman, Symmons, Zurn and Toto
 - 3. Stainless Steel Sinks: Elkay, Just, Kohler
 - 4. Trim: American Standard, Brasscraft, Kohler, McGuire and Zurn
 - 5. Drains, Carriers and Hydrants: Josam, Mifab, Prier, Jay R. Smith, Wade and Zurn
 - 6. Carriers: Jay R. Smith, Zurn and Josam
- B. Refer to plumbing drawings for fixture selections.

PART 3 EXECUTION

3.01. INSTALLATION

- A. All wall hung fixtures shall be supported on concealed chair carriers furnished complete with all necessary bolts, nuts, washers and gaskets unless noted otherwise. The adjustable nipple between the cast iron fitting and the closet bowl shall be threaded cast iron. Secure all floor pieces to floor slab.
- B. All exposed piping in connection with fixtures shall be chromium plated. Where supply and waste lines pass through walls, provide chromium plated escutcheons and firmly secure in place.
- C. Provide straight or angle supply valves on inlet supplies to all fixtures.
- D. Fixtures, trim and methods of piping and installation shall conform to local plumbing code. All fixture types shall be the product of one manufacturer. All fixtures shall be white unless otherwise noted.
- E. Fixtures shall be cleaned, adjusted and left in proper working order before the project is turned over to the Owner. Flush and clean all faucet aerators prior to turn over. Adjust all faucet lever handles to be parallel to adjacent rear wall in the off position.
- F. The Contractor shall furnish and install protective guards as required to protect fixtures against damage by normal operations of other trades.
- G. Caulk all floor and counter top mounted fixtures and behind all wall-hung plumbing fixtures with white, non-shrinking, silicone caulking eliminating all voids and cracks.
- H. Coordinate the mounting height of all fixtures with the Architect prior to installation.
- I. The Contractor shall obtain exact information relative to finish grade of the top of the floor drains. All floor drains shall be set flush with finished floors.
- J. Cleanouts shall be provided where indicated on drawings and elsewhere as required by code.
- K. Where test tees are installed at the base of the stack or on the stack, they may be used as a cleanout.
- L. Provide the Owner with three (3) wrenches for removing flush cleanout plugs.

END OF SECTION 15450

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SECTION 15830

UNITARY EXHAUST AND SUPPLY FANS AND VENTILATORS

PART 1 GENERAL

1.01. DESCRIPTION

- A. Refer to specification section 15000 - HVAC General, all of which applies to work described in this section as if written in full herein.
- B. Furnish and install all unitary exhaust and supply fans and ventilators of the size, type, capacity and characteristics as shown on the equipment schedules and herein described.
- C. Acceptable manufacturers include only those whose products have been in satisfactory use in similar service for not less than five (5) years.
 - 1. Loren Cook Company (www.lorencook.com) or approved equal.
- D. Electrical Standards: Provide electrical motors and products which have been listed and labeled by Underwriters Laboratories Inc. and comply with NEMA Standards.
- E. Certification, Fan Performance: Provide fans whose performance is certified by AMCA under the specified conditions.

PART 2 PRODUCTS

2.01. CENTRIFUGAL AND AXIAL FANS AND VENTILATORS

- A. All units shall be rigidly constructed of materials suitable for the intended service and shall be installed with all accessories listed on the Drawings.
- B. All roof mounted units shall be installed on factory supplied 12-inch high (minimum) insulated roof curbs of the proper type, size and construction for proper mounting. Curbs shall account for all roof slopes and pitches so that the unit is installed level. Units shall be anchored to curbs by a minimum of two lag screws of adequate size on each side. Curbs shall be constructed of galvanized steel, except when the project is located within 5 miles of a sea coast they shall be of aluminum construction.
- C. Outdoor fans shall be completely weatherproof for outdoor installation and shall contain internal vibration isolation to assure smooth and quiet performance.
- D. Fan wheels and blades shall be constructed of aluminum and shall be statically and dynamically balanced at the factory.

2.02. CEILING-CENTRIFUGAL AND CABINET FANS

- A. Units shall be direct-drive type with back-draft damper, acoustically insulated cabinets and speed controller.

2.03. CEILING PROPELLER FANS

- A. Manufacturers:

1. Rite-Hite; Model Revolution HVLS Fan: www.ritehite.com;
www.ritehitefans.com
2. Hunter Fan Company: industrialfans.hunterfan.com.

- B. Product:

1. Diameter: As indicated on the mechanical drawings.
2. Number of Blades: As indicated on the mechanical drawings.
3. Blade Material: Aluminum.
4. Blade Finish: Mill-finish.
5. Motor: As indicated on the mechanical drawings.
6. Electrical Requirements: As indicated on the mechanical drawings.
7. Maximum Decibels: 63 dBA (measured 20 feet below and 20 feet from the fan's center).
8. Controls: Variable speed. on/off.
9. Controls: Fan Commander - controls up to 18 fans independently.
10. Mounting Heights: As indicated on the mechanical drawings.
11. Fan Weight: As indicated on the mechanical drawings
12. UL Listed to 507 Standard.

- C. Construction:

1. Fan shall have formed aluminum blades that shall have contour and twist for maximum air movement. Each blade shall be connected to the hub of the fan by means of 1- 24 mm x 100 mm threaded bolt that is tightened to 200-ft.-lbs. to provide a rotationally balanced blade and hub. The hub of the Fan shall be extruded precision-milled aluminum. The hub shall incorporate a safety ring attached to each blade arm that will support the hub and blades in case of a motor shaft failure.
2. Fan shall be supported by cables that wrap around joist and mounting brackets and with four stabilization cables.

3. The controls shall consist of a power disconnect switch, power on/off switch and a touchpad to control the speed of the fan. Each control box shall be UL listed to U.S. and Canadian Safety Standards NEMA 4X control box. Each fan controller will include a factory programmed Solid-State Frequency Drive (VFD) to provide a soft-start for the fan as well as infinite speed control capability for the fan. Each control box shall have Touch-Safe internal components, including in-line fusing and a line reactor for three-phase power.

PART 3 EXECUTION

3.01. GENERAL

- A. All units shall be installed in accordance with manufacturer's recommendations and as shown on the Drawings.
- B. Ceiling-centrifugal and cabinet fans shall be supported from structural members and shall not rest on the ceiling, on lights or on structural members.
- C. Units shall be interlocked and controlled as indicated on the Drawings.
- D. Ceiling-mounted units shall be installed with ceiling grilles flush with the ceiling.
- E. Curb-mounted fans shall be secured to the roof curb with lag screws in each hole in the fan curb cap.
- F. Electrical connection to the fan motor shall be made through the roof opening inside the roof curb.
- G. Roof mounted fans shall be labeled on the equipment visible from the roof as well as on the underside of the roof under the equipment, visible and readable from the slab below. Under side of roof labeling of rooftop equipment shall be, as a minimum, 4" high letters, with standard fiberboard stencils and standard black (or other appropriate color) exterior stencil enamel.
- H. Equipment labeling shall be one of the following, unless noted or specified otherwise:
 1. Permanently attached plastic laminated signs with 1" high lettering
 2. Stencil painted identification, (2" high letters for exterior of building labeling, 4" high letters for labeling of rooftop equipment under roof deck), with standard fiberboard stencils and standard black (or other appropriate color) exterior stencil enamel.

END OF SECTION 15830

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SECTION 15855

ROOF CURBS

PART 1 GENERAL

1.01. GENERAL REQUIREMENTS

- A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 15000 - HVAC General.

1.02. WORK INCLUDED

- A. Receipt, unloading, handling, proper storage and protection from damage of all materials.
- B. Layout and coordination of work with other trades.
- C. The work included under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install curbs complete as indicated on the Drawings and as specified herein.

PART 2 PRODUCTS

2.01. GENERAL

- A. Prefabricated curbs for HVAC equipment located on the roof shall be manufactured by Custom Curb, Inc., Pate, Thycurb, Roof Products and Systems, Inc., or approved equal.

2.02. ROOF CURBS

- A. Curbs shall be Series CRC-3 fabricated to match any roof slope and have a minimum height of 16". Coordinate with the roof system used so that a minimum of 8" of the curb is above the finished roof for flashing purposes. The top of the curb shall be level and the slope of the roof shall be compensated for by the curb.
- B. Curbs shall be a minimum of 18-gauge galvanized steel construction (or as deemed necessary by the curb manufacturer to support unit load) with fully mitered and welded corners and self-flashing without cant. The curb shall not sag more than 1" in 240" + or - when supporting the unit at the corners of curb only. The curb shall be internally reinforced with angle iron, factory insulated with 1-1/2", 3 lb. density fiberglass insulation, and shall be complete with factory installed pressure treated wood nailers. Coordinate sizes to match frames provided by others. When the project is located within 5 miles of a sea coast, curbs shall be of aluminum construction.

PART 3 EXECUTION

3.01. INSTALLATION

- A. Installation shall be in strict accordance with the manufacturer's printed instructions and as detailed on the Drawings. Curb manufacturer shall coordinate with HVAC and General Contractor.

END OF SECTION 15855

SECTION 15950

TESTING, ADJUSTING AND BALANCING (TAB)

PART 1 GENERAL

1.01. DESCRIPTION

- A. Refer to specification section 15000 - HVAC General, all of which applies to work described in this section as if written in full herein.
- B. The work described by this section of the specifications consists of furnishing all materials, instruments, labor, and appurtenances to test, adjust and balance all of the HVAC systems furnished and installed under Division 15 of the specifications.
- C. The TAB agency shall be a subcontractor of the General Contractor and shall not report to or be paid by the HVAC Contractor. The HVAC subcontractor shall be responsible to cooperate with and provide for the balancing subcontractor any and all materials, services, labor, etc. to facilitate completion of the balancing work.

1.02. QUALITY ASSURANCE

- A. The TAB agency and its specialist shall be certified members of Associated Air Balance Council (AABC) to perform TAB service for HVAC, and vibration and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. The TAB agency shall have been in business for at least the past five years and must be free of disciplinary action by the AABC during that time.
- B. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and complexity of this project and must be certified so by the TAB agency in writing.
- C. The basic instrumentation shall be calibrated to accuracy requirements by its manufacturer and AABC Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems. Provide calibration history of the instruments to be used for test and balance purpose.
- D. One or more of the applicable AABC or SMACNA publications, supplemented by the ASHRAE Handbooks and requirements stated herein shall be the basis for planning, procedures, tolerances and reports.
- E. Final report shall cite the exact names of publications used as a basis or reference for the TAB work or reports.

PART 2 PRODUCTS

2.01. MATERIALS

- A. Provide plastic plugs to seal holes drilled in ductwork for test purposes.
- B. Provide for repair of insulation removed or damaged for TAB work to match installation.

PART 3 EXECUTION

3.01. TAB PROCEDURES

- A. TAB shall be performed in accordance with the requirements of the Standard under which the TAB agency is certified, by AABC.
- B. During TAB all related system components shall be in full operation. Fan and pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable volume air or water systems for test and balance work.
- C. Adjustment of the temperature controls shall be coordinated by the TAB work specialist in conjunction with the Automatic Temperature Control Company's Engineer. Both shall cooperate to simulate a complete cycle for every system in every mode of operation (automatic, economizer, fire emergency, etc.).

3.02. AIR SYSTEMS TAB

- A. Systems shall be tested, adjusted and balanced so that air quantities and temperatures at outlets are as shown on the Contract Drawings and so that the distribution from supply outlets is uniform over the face of each outlet.
- B. Direct reading velocity meters may be used for comparative adjustment of individual outlets, but air quantities in ducts having velocities of 1,000 feet per minute or greater shall be measured by means of pitot tubes and inclined gauge manometers. Instrument test opening enclosures shall be provided as required at the direction of the TAB agency.
- C. Adjustments shall be made in such a manner that splitter and volume adjusters close to air outlets will have the least pressure drop consistent with volume requirements. Primary balancing shall be obtained by adjustment of the dampers at branch duct take-offs. Adjustable fan drives shall be used for making final adjustments of total air quantities. Additional dampers or other air volume adjusters required to accomplish the balancing and adjusting shall be furnished and installed as part of the HVAC work.

- D. Artificially load air filters by partial blanking to produce air pressure drop of at least 90 percent of the design final pressure drop.
- E. Check and readjust factory set minimum and maximum air terminal unit flow rates if necessary. Balance air distribution on full cooling maximum. Reset room thermostats and check operation from maximum to minimum cooling, to the heating mode, and back to cooling. Record and report the heating coil leaving air temperature when in the maximum heating mode.
- F. Adjust fan speeds to provide design air flow. Adjust V-belt drives, including fixed pitch pulley requirements.
- G. After completion of the testing, adjusting and balancing of the air systems, six (6) copies of a recognized complete set of reports showing the minimum following information shall be submitted to the Engineer for review:
 - 1. Systems inspection narrative on equipment and installation for conformance with design
 - 2. Duct Air Leakage Test Report
 - 3. Systems Readiness Report
 - 4. TAB report covering flow balance and adjustments, performance tests, vibration tests and sound tests. Required information:
 - a. Location of each air outlet or inlet. This shall be presented in the form of a reduced size floor plan showing outlet number keyed to the outlet number in the report.
 - b. Dimensions or size of each outlet or inlet
 - c. Type and manufacturer of diffusers, grilles, registers. Indicate duty as supply, return, exhaust, etc.
 - d. Cfm of air as indicated on the Drawings for each outlet or inlet with corresponding velocity
 - e. Velocity of air as measured and corresponding cfm at which system has been balanced and adjusted, for each outlet or inlet
 - f. Velocity of air measured and corresponding cfm, after each complete system has been balanced and adjusted, for each main branch or zone duct at the supply fan, the return fan and the exhaust fan, as the case may be
 - g. After each complete system has been balanced and adjusted, the total cfm at fan discharge, the total return air to the apparatus, the total outside air to the apparatus, the total outside air to the apparatus, static pressure at fan outlet, total static pressure for apparatus, fan speed, motor amperage for each phase and voltage

5. Narrative of uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements
- H. The above testing, adjusting and balancing shall be performed for the first season of the year, cooling season or heating season, which occurs at the completion of the building. Additional balancing and adjusting which may be required for the season of the year next following shall be performed as part of the work under this specification.

3.03. VIBRATION TESTING

- A. Furnish instruments and perform vibration measurements for all rotating HVAC equipment of 1/2 horsepower and larger, including centrifugal/ screw compressors, cooling towers, pumps, fans and motors.
- B. Record initial measurements for each unit of equipment on test forms and submit a report to General Contractor. Where vibration readings exceed the allowable tolerance, the HVAC Contractor shall correct the problem and the TAB agency shall verify the corrections are done for final reporting.

3.04. SOUND TESTING

- A. Perform and record required sound level measurements in approximately 15% of all rooms as designated by the General Contractor.
- B. Take measurements with a calibrated sound level meter and octave band analyzer of the accuracy required by AABC or NEBB.
- C. Where measure sound levels exceed specified levels, the installing contractor or equipment manufacturer shall take remedial action approved by the General Contractor and the necessary sound tests shall be repeated.

3.05. MARKING OF SETTINGS AND TEST PORTS

- A. Following the approval of the final TAB Report, the setting of all HVAC adjustment devices including valves, splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the General Contractor.
- B. The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapor barrier.

END OF SECTION 15950

SECTION 16000
ELECTRICAL GENERAL

PART 1 GENERAL

1.01. GENERAL REQUIREMENTS

- A. General Conditions: Refer to the General Conditions, the Supplementary General Conditions and the Special Conditions, all provisions of which apply to work under this section as if written in full herein.
- B. The scope of work to be done under this section of the specifications shall include the furnishing of labor, material, equipment and tools required for the complete installation of systems for power, lighting, signals and all other work indicated on the drawings or as specified herein. A 100% operational building and electrical distribution system up to a connection point for Owner furnished equipment will be provided.
- C. The drawings and specifications are complementary to each other and what is called for by one shall be as binding as if called for by both.

1.02. STANDARDS

- A. All work shall conform to all ordinances and regulations of the City, County, State and/or other authorities having jurisdiction in accordance with the requirements of the following codes, standards and design guides:
 - 1. The National Electrical Code NFPA 70 with North Carolina Amendments
 - 2. The North Carolina State Building Code
 - 3. The North Carolina State Fire Prevention Code
 - 4. Regulations of the local utility company with respect to metering and service entrance
 - 5. Local city and county ordinances governing electrical work
 - 6. Americans with Disabilities Act (Public Law 101-336)

1.03. PERMITS

- A. The Contractor shall obtain all permits and inspections required for the installation of this work and pay all charges incident thereto. He shall deliver to the Architect all certificates of said inspection.

1.04. WORK INCLUDED

The electrical systems installed and work performed under this division of the specifications shall include but not necessarily be limited to those listed below. All materials and appliances, obviously a part of the electrical systems and necessary to its proper operation, but not specifically mentioned or shown on the drawings, shall be furnished and installed without additional charge.

- A. Power Distribution System
- B. All lighting systems (indoor and outdoor, normal, emergency and exit) including all fixtures, lamps, plaster and/or tile frames, standards, switches, outlets, wiring, dimmers, contactors, time clocks, photocells, batteries, raceways and other components and fittings required for complete lighting systems
- C. Wiring, including power circuit connections for HVAC, plumbing and other mechanical equipment
- D. Grounding Systems
- E. Temporary service lighting and power system
- F. Low voltage system raceways and equipment mounting boards as indicated on the drawings
- G. Underground raceway excavation, backfill, and compaction
- H. Fire Alarm System
- I. Concrete work for duct banks, manholes, covering, lighting standard bases and equipment bases (where not assigned to General Contractor)
- J. Electrical Equipment Identification
- K. Supporting Devices for Electrical Components
- L. Work as required by electric and telecommunication utilities, as well as the coordination of additional work (i.e. work performed by the utility) with that of other trades

1.05. DRAWINGS

- A. Drawings are generally diagrammatic and show the arrangement and location of fixtures, equipment and conduit. The Contractor shall carefully investigate the structural and finish conditions affecting his work and arrange his work accordingly. Should conditions on the job make it necessary to rearrange conduit or equipment, the Contractor shall so advise the Engineer and secure approval before proceeding with such work.

- B. Where exact locations are required by equipment for stubbing-up and terminating conduit concealed in floor slabs, the Contractor shall request shop drawings, equipment location drawings, foundation drawings, and any other data required by him to locate the concealed conduit before the floor slab is poured.
- C. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.
- D. Locate pull boxes, panelboards, control pushbuttons, terminal cabinets, safety switches and such other apparatus as may require periodic maintenance, operation, or inspection, so that they are easily accessible. If such items are shown on the plans in locations which are found to be inaccessible, the Engineer must be advised of the situation before work is advanced to the point where extra costs will be involved.
- E. All additional circuit connections to panelboards must be preapproved by the Engineer.
- F. The location, arrangement and extent of equipment, devices, conduit, and other appurtenances related to the installation of electrical work shown on drawings are approximate. The Contractor shall not scale drawings, but shall refer to the architectural drawings for exact dimensions of building components. Should a conflict exist between the architectural and engineering drawings regarding dimensions and scale, the Contractor shall notify the Architect of the discrepancy.
- G. Verify the ceiling type, ceiling suspension systems, and clearance above hung ceilings prior to ordering lighting fixtures. Notify the Engineer of any discrepancies.
- H. Review all architectural drawings for door swings, cabinets, counters and built-in equipment.

1.06. OPERATION AND MAINTENANCE MANUALS

- A. The Contractor shall prepare a minimum of three (3) instruction manuals, one of which shall be submitted to the Architect for the Engineer's review, describing installation, operation and maintenance of all Electrical equipment. Manuals shall include copies of control schematics, sequences of operation, indicate the function and operations of all components, as well as the Contractor's name, address, and telephone number. Manuals shall also contain one copy of all manufacturer's drawings, pamphlets, data, parts lists, and instruction manual for each piece of equipment. Upon approval, two (2)

copies shall be delivered to the Owner; one (1) copy shall be kept by the Contractor. The pamphlets and drawings are to be neatly bound in a 3-ring binder(s). One (1) electronic copy shall be delivered to the Owner.

1.07. AS-BUILT DRAWINGS

- A. The Contractor shall maintain a record of all changes in the work from that shown in the Contract Documents. After all work is completed, the Contractor shall prepare a set of “as-built” reproducible drawings of similar type and quality as the Contract Drawings that reflect all changes and that accurately show actual final construction, and deliver these drawings to the Owner. Provide electronic color copy in addition to originals.

1.08. EQUIPMENT, MATERIALS AND BID BASIS

- A. Manufacturers’ names, model numbers, etc. as specified on the drawings and herein are for the purpose of describing type, capacity, function and quality of equipment and materials required.
- B. Unless “approved equal” is specifically stated, bids shall be based on equipment names in specifications or on drawings as “base” products.
- C. “Equal product” and “approved equal” items listed shall conform to specified base items and shall be substantially equal in size, weight, construction and capacities. The “equal” equipment and materials shall be submitted as full equivalent to the equipment and materials specified, with sufficient supportive documentation and technical literature to demonstrate quality, performance, and workmanship without doubt or question. Submittals for “equal” products shall be made at least ten (10) days prior to bid (refer to the General Conditions of these specifications). The Engineer shall consider the use of the “equal” equipment based on the supportive documentation available to him, and shall approve or disapprove any proposed alternates. The decision of the Engineer shall, in all cases, be final.
- D. The Contractor shall coordinate the installation of all electrical equipment proposed for use in this project with all building trades (architectural, structural, fire sprinkler protection, mechanical, etc.). Coordination shall be accomplished prior to, and shall be reflected in, the submittal of shop drawings for approval. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy the plans and specifications.
- E. If substitutions are made in lieu of equipment specified, the manufacturer’s literature shall be submitted to the Engineer for approval. In the case of lighting fixtures, full IES photometric test reports for the fixture, lamp(s), and lenses shall be submitted for approval.

1.09. SUBMITTALS

- A. The Contractor shall prepare, submit, and obtain Engineer's review of manufacturers' submittals on the following equipment and systems prior to ordering, purchasing, or installation of any equipment or materials. All required submittals shall be transmitted simultaneously in hard ring binders with the associated specification section and the item submitted clearly identified. Partial submittals will be returned without review.

1. Submit a listing of all the materials indicated below, with the type of material, manufacturer and catalog or model number for each (where applicable):

Package #1

Conductors

Conduit

Multiconductor Cables

Wiring Devices and Plates

Disconnect Switches

Time Switches

Photocells

Lighting Contactors

2. Submit complete shop drawings of the following when supplied by the electrical contractor:

Package #2

Fuses and/or Circuit Breakers

Short Circuit and Coordination Study

Switchboards

Transformers

Surge Protective Devices

Motor Control Centers with typical schematic of starters

Panelboards and Cabinets

Package #3

Lighting Fixtures

Occupancy Sensors

Lighting Control Panels

Package #4

Generator Set

Transfer Switch

Package #5

Fire Alarm System

3. Submit test reports as required in section 3.07 - Electrical Testing.

- A. All shop drawing approvals required by any code or enforcement authority, insurance underwriter, etc. shall be obtained prior to being submitted to the Engineer.
- B. Review of shop drawings by the Engineer does not relieve the Contractor from responsibility for complying with all requirements of the Contract Documents. Furthermore, it shall be the responsibility of the Contractor to coordinate the requirements (roof penetrations, wall penetrations, floor penetrations, curbs, electrical, etc.) of all approved equipment with the other trades and disciplines at no additional cost.
- C. All shop drawings shall be identified by the equipment mark or tag identification numbers shown on the Contract Drawings. Each individual submittal item shall be marked to show which specification section pertains to the item.

1.10. COORDINATION OF TRADES

- A. The Contractor shall give full cooperation to other trades, and shall furnish all information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay.
- B. Work shall not be performed without first coordinating the installation of same with other trades. The Contractor, at his own expense, shall relocate all uncoordinated equipment installed should they interfere with the proper installation and mounting of mechanical equipment, fire sprinkler protection, ceilings and other architectural or structural finishes.
- C. The Contractor shall coordinate the elevations of all equipment above ceilings and in exposed areas with the work of all other disciplines prior to installation.
- D. In areas where more than one trade is required to use common openings in beams, joists, chases, shafts and sleeves for the passage of conduits, raceways, piping, ductwork and other materials, the Contractor must

coordinate the positions of all piping and equipment to be furnished under this section so that all items including the materials and equipment of other trades may be accommodated within the space available.

- E. The Contractor shall confirm that work installed under this section does not interfere with the clearances required for finished columns, pilasters, fire sprinkler system, partitions, walls or other architectural or structural elements as shown on the Contract Documents.
- F. Work that is installed under this Contract which interferes with the architectural design or building structure shall be removed and relocated as required at no additional cost to the Contract.
- G. The following are the most common rules found in the standard for handling obstructions located entirely below the sprinklers. Compliance with these rules in no way relieves the contractor from full compliance with the standard.
 - 1. Individual obstructions measuring 3/4 in.-wide or less and at least 4 in. below the sprinkler deflector may be ignored.
 - 2. Continuous obstructions wider than 3/4 in. and no wider than 2 in. shall be located at least 12 in. horizontally from the centerline of the sprinkler or at least 24 in. vertically below the sprinkler deflector.
 - 3. Continuous obstructions wider than 2 in. and no wider than 12 in. shall be located at least 12 in. horizontally from the centerline of the sprinkler.
 - 4. Continuous obstructions wider than 12 in. and no wider than 24 in. shall be located at least 24 in. horizontally from the centerline of the sprinkler.
 - 5. Isolated rectangular or round obstructions (such as light fixtures, junction boxes, etc.), in which all dimensions parallel to the floor are no greater than 24 in., shall be located at least 12 in. from the centerline of the sprinkler.

1.11. WARRANTY

- A. All equipment furnished and installed under this Contract shall be provided with the manufacturer's standard warranty unless otherwise noted.
- B. The Contractor shall make good all defects in material, equipment, or workmanship disclosed within a period of one (1) year from date of building acceptance by the Owner. The phrase "make good" shall mean to furnish promptly, without charge, all work necessary to remedy the defects to the satisfaction of the Engineer.

1.12. TEMPORARY LIGHT AND POWER

- A. The Contractor shall provide a temporary service of the amperage and voltage required by the General Contractor.
- B. Sufficient wiring, outlets and lamps shall be installed to ensure proper lighting in accordance with OSHA, state and municipal codes. Refer to Division 1 specifications for requirements.

1.13. EQUIPMENT REQUIRING ELECTRICAL SERVICE

- A. Review all specification sections and drawings including mechanical, plumbing and other equipment drawings and other divisions of the specifications for equipment requiring electrical service. Provide service to and make connections to all such equipment requiring electrical service.
- B. Prior to installing material such as electrical equipment, devices, feeders, or branch circuits serving equipment of all other trades, the Contractor shall coordinate with the electrical requirements of the equipment to be installed.

1.14. MECHANICAL SYSTEMS COORDINATION

- A. All control wiring for mechanical systems shall be installed under Division 15.
- B. Motor controllers (starters) shall be furnished under Division 15 and installed under Division 16, unless specified otherwise.
- C. Power wiring to all motors and motor controllers and between motors and controllers shall be provided in Division 16.

PART 2 PRODUCTS

2.01. GENERAL REQUIREMENTS

- A. All equipment, materials, accessories, etc. used shall be new and of current production unless specified otherwise. Equipment not specified in the Contract Documents shall be suitable for the intended use and shall be subject to approval by the Engineer.
- B. All equipment, products and materials shall be free of defects and shall be constructed to operate in a safe manner without excessive noise, vibration, leakage, or wear.
- C. All equipment shall bear the inspection label of Underwriters Laboratories Inc.
- D. All equipment and material for similar applications or systems shall be provided from the same manufacturer unless noted otherwise.
- E. The published standards and requirements of the National Electrical Manufacturers Association, the American National Standard Institute, the

Institute of Electrical and Electronic Engineers, and the American Society of Testing Materials, are made a part of these specifications and shall apply wherever applicable.

2.02. IDENTIFICATION

- A. Equipment or devices specified in the individual sections to be identified shall be identified by machine cut stencil unless the equipment is identified by the manufacturer. Identification of flush mounted cabinets and panelboards shall be on the inside of the device. Surface mounted equipment shall be identified on the outside cover. Equipment operating on 208Y/120 volt system shall be identified with black labels with white inner core, 480Y/277 volt equipment with white labels with black inner core. Equipment on the emergency/standby power system operating at 208/120 volts shall be identified with red labels with white inner core, 480/277 volt equipment with white labels with red inner core.
- B. All switchboards and panelboards supplied by a feeder shall be stencil-labeled to indicate the equipment where the power supply originates.
- C. All devices, disconnect switches, contactors, relays, enclosed circuit breakers, and equipment in the warehouse receiving power connections shall be provided with a permanent label identifying the panel and circuit number that serves the device, equipment, disconnect switch, etc.

PART 3 EXECUTION

3.01. GENERAL REQUIREMENTS

- A. Mounting heights, unless otherwise noted, are to be center line of the equipment and/or device except the mounting height of suspended light fixtures which is to the bottom of fixture.
- B. All work shall be designed and installed to comply with the requirements for the seismic design category and use group for the area in which the building is constructed.

3.02. EXCAVATION, TRENCHING & BACKFILLING

- A. Contractor shall call underground utilities locator company before digging.
- B. Barricades shall be provided around open holes and trenches. Temporary bridges shall be provided over trenches cut through major sidewalk routes.
- C. When rocks, concrete or other debris are encountered during excavation, remove completely.
- D. Where sidewalk sections must be removed for installation of underground ducts, remove the sidewalk sections completely from joint to joint.

- E. Where asphalt must be removed for installation of underground ducts, saw cut the asphalt in two, straight, parallel lines.
- F. Backfill excavations in 6-inch layers and mechanically compact to 98 percent compaction. Compaction to be tested.
- G. Excavated materials may be used as backfill only if the backfill is sand or clean dirt that is free of rocks and debris over 3/4" in diameter.
- H. In landscaped areas, backfill and mechanically compact to a depth of 6 inches below grade.
- I. The Contractor shall perform all excavation to install the work herein specified and as indicated on drawings. During excavation, material for backfilling shall be piled back from the banks of the trench to avoid overloading and to prevent slides and cave-ins. All excavated materials not to be used for backfill shall be removed and disposed of by the Contractor. Grading shall be done to prevent surface water from flowing into trenches and other excavation and any water accumulating therein shall be removed by pumping. All excavation shall be made by open cut. No tunneling shall be done except under pavement.
- J. The bottom of the trenches shall be graded to provide uniform bearing and support for conduits, cables, or duct bank on undisturbed soil at every point along its entire length. Overdepths shall be backfilled with loose, granular, moist earth, and tamped and compaction tested. Remove unstable soil that is not capable of supporting equipment or installation and replace with specified material for a minimum of 12" below invert of equipment or installation.
- K. The trenches shall be backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand and gravel or soft shale, free from large clods of earth and stones, deposited in 6" layers and tamped until the crown of the pipe is covered by a minimum of 6" of tamped earth. The backfill under and beside the pipe shall be compacted for pipe support. Backfill shall be brought up evenly on both sides of the pipe so that the pipe remains aligned. In instances where the manufacturer's installation instructions for materials are more restrictive than those prescribed by the code, the material shall be installed in accordance with the more restrictive requirement. The backfilling shall be carried on simultaneously on both sides of the trench so that injurious pressures do not occur. The compaction of the filled trench shall be at least equal to 98% of the maximum density as determined by the Standard Proctor Test. Settling the backfill with water will not be permitted. Reopen any trenches not meeting compaction requirements or where settlement occurs, refill, compact, and restore the surface to the grade and compaction indicated, mounded over and smoothed off. A metallic lined underground warning tape shall be provided 12" below finished grade.

The tape shall be red for electrical lines and orange for telephone and shall be identified as to the type of line.

- L. Perform excavation and backfilling work in accordance with applicable portions of the earthwork section.

3.03. STORAGE AND PROTECTION OF MATERIALS

- A. Refer to the general requirements section of the specifications, Division 1, for storage, protection, and handling requirements.
- B. Inspect materials upon arrival at project and verify conformance to Contract Documents. Prevent unloading of unsatisfactory material.
- C. Store packaged materials in original undamaged condition with manufacturer's labels and seals intact.
- D. Containers which are broken, opened, watermarked, or otherwise damaged materials are unacceptable and shall be removed from premises.
- E. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable to protect the equipment or materials. Equipment or materials damaged or which are subjected to these elements are unacceptable and shall be removed from the premises and replaced.

3.04. CONCRETE WORK

- A. Construct curbs, pads, vaults and similar supports for electrical equipment where required.
- B. Provide 4" thickness housekeeping pads at floor mounted equipment, covering entire area occupied by equipment. Dowel pads to structural slab.
- C. Perform concrete work in accordance with applicable portions of Concrete sections. Minimum compressive strength of concrete shall be same as specified for slabs on grade.

3.05. PAINTING

- A. Except as otherwise specified, painting shall be accomplished under Painting Section. Surfaces shall be left clean of debris and free from oil and other substances which would prevent paint bond.
- B. Touch up finishes of factory painted apparatus where finish is marred during installation.
- C. Where galvanizing is broken during fabrication or installation, recoat exposed areas with cold galvanizing compound.

- D. Do not paint over nameplates on equipment, nonferrous hardware, accessories or trim.

3.06. WORKMANSHIP

- A. Install systems, materials and equipment level and plumb, parallel and perpendicular to other building systems and components.

3.07. ELECTRICAL TESTING

- A. Furnish all labor, materials, instruments, supplies, and services and bear all costs for the accomplishment of the tests herein specified or requested at job site. Correct all defects appearing under test, and repeat the tests until no defects are disclosed, leave the equipment clean and ready for use.
- B. All grounds, crosses, shorts, etc., must be eliminated from the wiring. Test all lighting fixtures, together with switches and controls; test the operation of all motors, controllers, and other electrical equipment devices.
- C. The switchboard and all feeders shall be Meggar tested. A copy of all test reports shall be given to the Engineer.
- D. The Contractor shall perform any tests other than herein specified which may be required by the Engineer or the authority having jurisdiction.
- E. Perform the following tests after installation but before energizing the equipment. The following tests and procedures apply to all equipment and material that is to be tested under this Contract.
 - 1. Transformers
 - a. Visually inspect all components for damage, check bushings and insulators for cracks; transformer casing for evidence of damage.
 - 2. Ground Resistance
 - a. Visually inspect for specified ground connections.
 - b. Perform ground resistance test at all connections to switchboards and panelboards.
 - c. Use three point or fall of potential method.
 - d. Verify single point connection (at the counterpoise) between the grounded and grounding systems.
 - e. Additional ground rod is required if resistance is greater than 25 ohms.
 - f. Submit ohm reading measurements.

3. Switchboards and Panelboards
 - a. Visually inspect all components for damage.
 - b. Check operation of circuit breakers/fusible switches.
 - c. Adjust breaker settings per coordination study.
 4. Ground Fault Systems
 - a. Visually inspect for damage and improper connections.
 - b. Adjust settings per coordination study.
 - c. Operate test button a minimum of three times.
 5. Transfer and Other Relay Schemes
 - a. Investigate intended function, and verify correct operation.
- F. The Engineer shall be notified immediately of any unfavorable test results or indication of faulty equipment. No piece of equipment shall be energized until the test data is evaluated and the equipment is proven acceptable.
- G. If the test and inspection data submitted should indicate deficiencies in the operation of the electrical apparatus or in the manufacturer thereof, the Contractor shall promptly implement the necessary adjustments, corrections, modifications and/or replacements necessary to meet the specified requirements.

3.08. TRAINING

- A. Upon completion of the work, the Contractor shall conduct operation and training session(s) for the Owner's key personnel. These sessions shall be of sufficient length and duration to adequately explain the design intent and proper operating and maintenance techniques for all equipment and systems. After these sessions are completed, the Contractor shall provide a copy of a signed statement by the Owner that his personnel are thoroughly familiar with and capable of operating all equipment and systems.

END OF SECTION 16000

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SECTION 16010

VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL

PART 1 GENERAL

1.01. SECTION INCLUDES

- A. Seismic control requirements.
 - 1. Includes requirements for seismic qualification of equipment not specified in this section.
- B. External seismic snubber assemblies.
- C. Seismic restraint systems.

1.02. DEFINITIONS

- A. Electrical Component: Where referenced in this section in regards to seismic controls, applies to any portion of the electrical system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., conduit, cable tray).
- B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.03. REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASCE 19 - Structural Applications of Steel Cables for Buildings 2016.
- C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions 2022.
- E. FEMA 413 - Installing Seismic Restraints for Electrical Equipment 2004.
- F. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage 2012.

- G. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components 2010, with Editorial Revision (2020).
- I. MFMA-4 - Metal Framing Standards Publication 2004.
- J. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- K. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.

1.04. ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Seismic Controls:
 - a. Coordinate the arrangement of seismic restraints with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
 - 5. Notify Engineer (Bass, Nixon & Kennedy, Inc.) of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured.

1.05. SUBMITTALS

- A. See Division 1 for submittal procedures.
- B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
 - 1. Seismic Controls: Include seismic load capacities.
- D. Shop Drawings - Seismic Controls:
 - 1. Include dimensioned plan views and sections indicating proposed electrical component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
 - 2. Identify mounting conditions required for equipment seismic qualification.
 - 3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
 - 4. Indicate proposed arrangement of distributed system trapeze support groupings.
 - 5. Indicate proposed locations for distributed system flexible fittings and/or connections.
 - 6. Indicate locations of seismic separations where applicable.
 - 7. Include point load drawings indicating design loads transmitted to structure at each attachment location.
- E. Seismic Design Data:
 - 1. Compile information on project-specific characteristics of actual installed electrical components necessary for determining seismic design forces required to design appropriate seismic controls, including but not limited to the following.
 - a. Component operating weight and center of gravity.
 - b. Component elevation in the building in relation to the roof elevation (z/h).
 - c. Component importance factor (I_p).

- d. For distributed systems, component materials and connection methods.
 - e. Component amplification factor (a_p) and component response modification factor (R_p), determined in accordance with ASCE 7 tables.
 - f. Applicability of overstrength factor (for certain anchorage in concrete and masonry).
2. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.
- F. Certification for seismically qualified equipment; identify basis for certification.
 - G. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.
 - H. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
 - I. Evidence of qualifications for seismic controls designer.
 - J. Evidence of qualifications for manufacturer.
 - K. Manufacturer's detailed field testing and inspection procedures.
 - L. Field quality control test reports.

1.06. QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with applicable building code.
- C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- D. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.
- E. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.
- F. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of experience.

1.07. DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01. SEISMIC CONTROL REQUIREMENTS

- A. Design and provide electrical component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor electrical components.
- B. Seismic Design Criteria: ICC (IBC).
 - 1. Seismic Design Category: C.
 - 2. Risk Category: II.
- C. Component Importance Factor (Ip): Electrical components essential to life safety to be assigned a component importance factor (Ip) of 1.5 as indicated or as required. This includes but is not limited to:
 - 1. Electrical components required to function for life safety purposes after an earthquake.
 - 2. Electrical components that support or otherwise contain hazardous substances.
- D. Seismic Qualification of Equipment:
 - 1. Provide special certification for electrical equipment furnished under other sections and assigned a component importance factor (Ip) of 1.5, certifying that equipment will remain operable following a design level earthquake.
 - 2. Seismic qualification to be by shake table testing in accordance with recognized testing standard procedure, such as ICC-ES AC156, acceptable to authorities having jurisdiction.
 - 3. Notify Engineer (Bass, Nixon & Kennedy, Inc.) and obtain direction where mounting restrictions required by conditions of seismic certification conflict with specified requirements.
 - 4. Seismically qualified equipment to be furnished with factory-installed labels referencing certificate of compliance and associated mounting restrictions.

E. Seismic Restraints:

1. Provide seismic restraints for electrical components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
2. Seismic Restraint Exemptions:
 - a. Exemptions for Seismic Design Category C:
 - 1) Electrical components with component importance factor (I_p) of 1.0.
 - b. Raceway Exemptions, All Seismic Design Categories:
 - 1) Conduits less than 2-1/2 inch trade size.
 - 2) Trapeze supported raceways weighing less than 10 pounds per foot.
 - 3) Hanger supported raceways where each hanger in the raceway run is 12 inches or less in length from the raceway support to the supporting structure; rod hangers, where used, to be equipped with swivels.
 - c. Lighting Exemptions, All Seismic Design Categories:
 - 1) Suspended luminaires where attachments are designed to accommodate 1.4 times the operating weight acting in both the vertical and horizontal directions and connections to structure allow for 360 degree range of motion in the horizontal plane; arrange to prevent impact between luminaires and the structure or other nonstructural components.
 - 2) Lay-in luminaires weighing less than 56 pounds secured to ceiling grid and provided with safety wires in accordance with ASTM E580/E580M.
3. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
 - a. ASHRAE (HVACA).
 - b. FEMA 413.
 - c. FEMA E-74.
 - d. SMACNA (SRM).
4. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party

registered professional engineer acceptable to authorities having jurisdiction.

5. External Seismic Snubber Assemblies:

- a. Provide quantity and arrangement of external seismic snubber assemblies as required to restrain equipment in all directions (both lateral and vertical).
- b. Do not use external seismic snubber assemblies that restrain equipment only in one or more lateral directions (but not vertical) except where uplift forces are zero or are addressed by other restraints.

6. Seismic Restraint Systems:

- a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
- b. Use only cable restraints to restrain vibration-isolated electrical components, including distributed systems.
- c. Use only one restraint system type for a given electrical component or distributed system (e.g., conduit, cable tray) run; mixing of cable and rigid restraints on a given component/run is not permitted.
- d. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain electrical component in all lateral directions; consider bracket geometry in anchor load calculations.
- e. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported electrical component weight.
- f. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported electrical component weight.
- g. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
- h. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
- i. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.

F. Seismic Attachments:

1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
3. Do not use power-actuated fasteners.
4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.
5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
6. Concrete Housekeeping Pads:
 - a. Increase size of pad as required to comply with anchor requirements.
 - b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.

G. Seismic Interactions:

1. Include provisions to prevent seismic impact between electrical components and other structural or nonstructural components.
2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.

H. Seismic Relative Displacement Provisions:

1. Use suitable fittings or flexible connections to accommodate:
 - a. Relative displacements at connections between components, including distributed systems (e.g., conduit, cable tray); do not exceed load limits for equipment utility connections.
 - b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
 - c. Design displacements at seismic separations.
 - d. Anticipated drifts between floors.

2.02. EXTERNAL SEISMIC SNUBBER ASSEMBLIES

A. Manufacturers:

1. External Seismic Snubber Assemblies:

- a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
- b. Mason Industries: www.mason-ind.com/#sle.
- c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
- d. Vibro-Acoustics: www.vibro-acoustics.com/#sle.
- e. Vibration Isolation: www.vibrationiso.com.

- 2. Source Limitations: Furnish external seismic snubber assemblies and associated accessories produced by a single manufacturer and obtained from a single supplier.

B. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.

C. Seismic Snubbing Elements:

- 1. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
- 2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

2.03. SEISMIC RESTRAINT SYSTEMS

A. Manufacturers:

1. Seismic Restraint Systems:

- a. AFCON, a brand of Anvil International: www.anvilintl.com/#sle.
- b. Eaton Corporation: www.eaton.com/#sle.
- c. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
- d. Mason Industries: www.mason-ind.com/#sle.
- e. Vibro-Acoustics: www.vibro-acoustics.com/#sle.
- f. Vibration Isolation: www.vibrationiso.com.

2. Source Limitations: Furnish seismic restraint system components and accessories produced by a single manufacturer and obtained from a single supplier.
- B. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.
- C. Cable Restraints:
 1. Comply with ASCE 19.
 2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
 3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
 4. Use protective thimbles for cable loops where potential for cable damage exists.
- D. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

PART 3 EXECUTION

3.01. EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02. CODE-REQUIRED SPECIAL INSPECTIONS

- A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner in accordance with statement of special inspections as required by the applicable building code. Refer to Section 01 4533.
- B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
 1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
 2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

- C. Seismic special inspections include, but are not limited to:
 - 1. Seismically Qualified Equipment: Verification that label, anchorage, and mounting comply with certificate of compliance.
 - 2. Anchorage of electric equipment for emergency and standby power systems for Seismic Design Categories C, D, E, and F; periodic inspection.
 - 3. Installation and anchorage of vibration isolation systems for Seismic Design Categories C, D, E, and F where Contract Documents require a nominal clearance of 1/4 inch or less between equipment support frame and seismic restraint; periodic inspection.
- D. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.
- E. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.03. INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install products in accordance with applicable requirements of NECA 1 (general workmanship).
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- D. Secure fasteners according to manufacturer's recommended torque settings.
- E. Install flexible conduit and cable connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
- F. Seismic Controls:
 - 1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris or other obstructions.
 - 2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
 - 3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.

4. Equipment with Sheet Metal Housings:
 - a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
 - b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
 - c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
5. Concrete Housekeeping Pads:
 - a. Size in accordance with seismic design to meet anchor requirements.
 - b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.
6. Seismic Restraint Systems:
 - a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
 - b. Install restraints within permissible angles in accordance with seismic design.
 - c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
 - d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.
 - e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.04. FIELD QUALITY CONTROL

- A. See Division 1 for additional requirements.
- B. Inspect vibration isolation and/or seismic control components for damage and defects.
- C. Provide services of a manufacturer's authorized representative for seismic controls to perform inspection and testing. Include manufacturer's detailed testing and inspection procedures and field reports with submittals.
- D. Seismic Controls:
 1. Verify snubbing element air gaps.

- E. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.
- F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION 16010

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SECTION 16110
CONDUIT AND RACEWAYS

PART 1 GENERAL

1.01. GENERAL REQUIREMENTS

- A. This section covers the complete interior and exterior conduit system.
- B. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 16000 - Electrical General.

1.02. STANDARDS

- A. Industry Standards
 - 1. Underwriters Laboratories Inc. (UL) Publications
 - No. 1: Standard for Flexible Metal Conduit
 - No. 6: Standard for Rigid Metal Conduit
 - No. 467: Standard for Grounding and Bonding Equipment
 - No. 651: Standard for Schedule 40 and 80 Rigid PVC Conduit
 - No. 797: Electrical Metallic Tubing - Steel
 - No. 1242: Standard for Electrical Intermediate Metal Conduit - Steel
 - 2. American National Standards Institute (ANSI)
 - C-80.1: Rigid Galvanized Conduit
 - C-80.3: Electrical Metallic Tubing

1.03. WORK INCLUDED

- A. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install conduits and raceways, complete, as indicated on the Drawings and as specified herein.
- B. Other manufacturers of equal quality and performance may be submitted to the Engineer for review. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

PART 2 PRODUCTS

2.01. MANUFACTURERS

- A. Approved Manufacturers
 - 1. Metallic Conduit Fittings
 - a. Thomas and Betts
 - b. Appleton
 - c. RACO
 - d. Crouse Hinds
 - e. Steel City
 - 2. Support Channel
 - a. Unistrut
 - b. Kindorf
 - 3. Non-metallic Conduit Fittings
 - a. Carlon
 - b. Georgia Pipe Company
 - 4. Rigid, IMC or Flexible Conduit
 - a. Allied
 - b. Republic
 - c. Triangle
 - d. Wheatland
 - e. Youngstown
 - f. Southwire
 - 5. Flexible Conduit (PVC Conduit)
 - a. Anaconda "Sealtite"
 - b. Robroy
 - c. Southwire
 - 6. Electrical Metallic Tubing
 - a. Steeltubes

- b. National
- c. Wheatland
- d. Allied
- e. Triangle
- f. Youngstown
- 7. Plastic PVC
 - a. Carlon
 - b. Georgia Pipe Company
- 8. Pull Box Manufacturer(s)
 - a. Hoffman
 - b. OZ Gedney
 - c. Or Approved Equal
- 9. Approved Marker Tape Manufacturer(s)
 - a. William Frick & Associates
 - b. Or Approved Equal
- 10. Approved Maintenance Hole/Handhole Manufacturer(s)
 - a. Old Castle
 - b. Pencil (Handholes Only)
 - c. Quazite (Handholes Only)
 - d. Or Approved Equal
- 11. Approved Conduit Plug/Cap Manufacturer(s)
 - a. Jack Moon
 - b. Or Approved Equal

2.02. CONDUIT FITTINGS

- A. Electrical metallic tubing (EMT) couplings and connectors shall be steel. Malleable iron, pressure cast or die cast fittings are not permitted.
- B. Fittings and couplings shall be set-screw type and/or compression type per 3.01 13. Steel set screw type for 2.5" conduit and larger shall have 2 screws for connectors and 4 screws for couplings. All connectors shall be insulated throat type.

- C. Rigid steel and IMC couplings and connectors shall be standard threaded couplings, locknuts, bushings and elbows. All materials shall be steel. Erickson-type couplings may be used to complete a conduit run.

2.03. NON-METALLIC CONDUIT AND FITTINGS

- A. Non-metallic conduit shall be heavy wall, Schedule 40 PVC.
- B. Couplings and connectors for non-metallic conduit shall be of the same material and be the product of the same manufacturer of the conduit furnished.
- C. PVC conduit for concrete encasement shall be Type DB, UL Labeled for 90 degrees C cables. Fittings shall be Type DB, solvent type, and from the same manufacturer as the conduit.
- D. Concrete shall have a minimum strength of 3,000 psi at 28 days.

2.04. CONDUIT SUPPORT

- A. Individual conduit hangers shall be galvanized spring steel specifically designed for the purpose and sized appropriately for the conduit type and diameter. Support individual conduits 1-1/2" and smaller with 1/4" threaded steel rods and use 3/8" rods for 2" and larger.
- B. Conduit support channels shall be 14-gauge galvanized (or equivalent treatment) channel sized for the amount of conduit to be supported. Channel suspension shall be 3/8" threaded steel rods. Conduit straps shall be spring steel type compatible with channel.
- C. Conduit straps shall be single-hole cast metal type or two-hole galvanized metal type. Conduit clamps shall be spring steel type for use with exposed structural steel.

2.05. RIGID METALLIC CONDUIT, INTERMEDIATE METALLIC CONDUIT, AND ELECTRICAL METALLIC TUBING

- A. Rigid metallic conduit and intermediate metallic conduit shall be steel and standard thread.
- B. Electrical metallic tubing (EMT) shall be steel.

2.06. RIGID METALLIC, INTERMEDIATE METALLIC, AND FLEXIBLE CONDUIT AND FITTINGS

- A. Rigid metallic conduit and intermediate metallic conduit shall be steel and standard thread.
- B. Flexible conduit shall be steel or aluminum type classified for system grounding.

- C. Connectors for flexible conduit shall be insulated throat type rated as suitable for system ground continuity.
- D. Flexible conduit used for other than connections to lighting fixtures shall not be less than 1/2" trade size. 3/8" flexible conduit may be used for connection to lighting fixtures when sized according to the National Electrical Code.
- E. Flexible conduit used in damp or wet locations shall be liquid tight.

2.07. PULL BOXES

- A. Pull boxes shall be constructed of galvanized steel with flat, removable covers fastened with plated steel screws.
- B. Pull boxes shall be equipped with keyhole screw slots in the cover to permit removal of the cover without extracting the screws.
- C. Pull boxes shall have provisions for grounding.

2.08. MAINTENANCE HOLES/HANDHOLES

A. Maintenance Holes

1. Maintenance holes shall be pre-cast or cast in place concrete with a strength of 3,500 psi at 28 days, steel reinforced, and traffic rated.
2. Maintenance holes shall include a cast iron frame with cover, a hot dipped galvanized steel ladder, and hot dipped galvanized pulling eyes embedded in the concrete opposite each duct entrance and in the floor beneath the cover.
3. Maintenance holes shall be equipped with grounding busbar.
4. Maintenance holes shall be equipped with racking for cable storage.
5. Ground splices and connections at maintenance holes shall be exothermic welds.
6. The cover for electrical maintenance holes shall have the lettering, "POWER" or "ELECTRIC."
7. The cover for low voltage maintenance holes shall have the lettering, "COMMUNICATIONS."

B. Handholes

1. Handholes shall be non-conductive and shall not require grounding for safety. Handholes shall be unaffected by freeze/thaw and resistant to sunlight and chemicals. Handholes shall be pre-cast polymer concrete, heavy duty rated and bottomless, traffic rated.

2. Handholes shall be equipped with racking for cable storage.
3. Electrical handholes shall have the word "POWER" or "ELECTRIC" molded in the cover by the manufacturer. The cover shall be attached with penta-head stainless steel bolts.
4. Low voltage handholes shall have the word "COMMUNICATIONS" molded in the cover by the manufacturer. The cover shall be attached with penta-head stainless steel bolts.
5. Handholes shall be able to withstand 10,000 lbs minimum.
6. See Drawings for handhole dimensions and locations.

2.09. CONDUIT PLUGS/CAPS

A. Conduit Plugs/Caps

1. Conduit plugs shall provide a watertight seal at expose ends of conduits.
2. Conduit plugs shall be conduit size specific.

PART 3 EXECUTION

3.01. INSTALLATION

A. General

1. Minimum size for electrical conduits shall be 1/2" trade size.
2. Minimum size for low voltage conduits shall be 3/4" trade size.
3. Conceal all conduits, except in unfinished spaces such as equipment rooms or as indicated by symbol on the drawings.
4. Leave all empty conduits with a 200 pound test nylon cord pull line.
5. Flattened, dented, or deformed conduits are not permitted and shall be removed and replaced.
6. Fasten conduit support device to structure with wood screws on wood, toggle bolts on hollow masonry, anchors as specified on solid masonry or concrete, and machine bolts, clamps, or spring steel clips, on steel.
7. Protect conduits against dirt, plaster, and foreign debris with conduit caps or plugs, which shall remain in place until all masonry is complete. Protect conduit stub-ups during construction from damage, any damage conduits shall not be used and are to be replaced.
8. All conduits shall be cleared of any dirt, foreign debris, etc.

9. Install conduit with wiring, including homeruns as indicated on the drawings. Any change resulting in a savings in labor or materials is to be made only in accordance with a Contract change. Deviations shall be made only where necessary to avoid interferences and when approved by Engineer by written authorization.
10. Conduits which penetrate roof membranes shall be installed in accordance with manufacturer's recommendations and architectural specifications.
11. Seal all conduits entering building from below grade and all conduits entering exterior mounted electrical equipment with insulating electrical putty to prevent entrance of moisture.
12. Separate raceway systems are to be installed for power systems and for control, signal and communications systems. Do not install control, signal or communications cables in the same raceways as branch circuit or feeders cables, unless indicated otherwise on the drawings.
13. Conduit fittings shall be set screw type for dry, indoor environments. Conduit fittings shall be gland and ring compression type for all conduit exposed to outdoor environments or wet locations.
14. Conduit shall be run parallel or at right angles to walls, ceilings, and structural members.
15. Support conduits at intervals not exceeding ten feet and within three feet of each outlet, junction box, fitting, panelboard, enclosure or cabinet. Support conduits from structural steel members with spring steel type or beam conduit clamps and to non-metallic structural members with one-hole conduit straps. For exposed conduits and where conduits must be suspended below structure, single conduit runs shall be supported from structure by hanger rod and conduit clamp assembly, and multiple conduits shall be supported by trapeze type support suspended from structure. Do not attach conduits to ceiling suspension system channels or suspension wires.
16. Attach conduits larger than one inch trade diameter to or from structure on intervals not exceeding twelve feet with conduit beam clamps, one-hole conduit straps or trapeze type support.
17. Where conduits must pass through structural members obtain approval of Architect.
18. Install all conduits or sleeves penetrating or routed within rated fire walls or fire floors to maintain fire rating of wall or floor. Conduit shall not be

installed in rated floors or walls if it compromises or violates the fire rating of floor or wall. Refer to architectural documents.

19. Provide expansion and deflection coupling where conduit passes over a building expansion joint.
20. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
21. Telephone and signal system raceways: 2" trade size and smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
22. Do not violate fire sprinkler clearances.

B. Uses Permitted

1. Conduits installed within concrete floor slabs which are in direct contact with grade shall be galvanized rigid steel (GRS), intermediate metal conduit (IMC) or Schedule 40, heavy wall PVC, or electrical non-metallic tubing (ENT).
2. Conduits which penetrate the building roof shall be galvanized rigid steel (GRS) or intermediate metal conduit (IMC).
3. Conduit run exterior exposed: Galvanized rigid steel (GRS).
4. Conduits in direct contact with earth shall be Schedule 40, heavy wall PVC. Elbows for underground conduits greater than 200' in length shall be galvanized rigid steel (GRS), or electrical metallic tubing (EMT) if elbows are concrete encased. Service entrance conduits installed exposed, or concealed in walls or above ceilings, shall be galvanized rigid steel (GRS) or intermediate metal conduit (IMC). Unless indicated otherwise, service entrance conduits shall be installed "outside" of the building as defined by the NEC. Provide concrete encasement where required or as indicated on drawings.
5. All other conduit, unless specified herein, not permitted in accordance with the NEC, or otherwise indicated on the drawings, shall be electrical metallic tubing (EMT). PVC conduit is not allowed in exposed or concealed areas, but only within concrete or below grade. Feeder or branch circuit conduits that emerge from a floor slab in an exposed location shall be galvanized rigid steel (GRS), electrical metallic tubing (EMT) or intermediate metal conduit (IMC).

6. Use flexible conduit for connections to motors, dry type transformers, electrical duct heaters, unit heaters, laundry equipment, flush mounted lighting fixtures, and any vibrating equipment.
 - a. Flexible conduit used for connection of motors, dry type transformers, electric duct heaters, unit heaters, and bus duct tap devices shall not exceed 36 inches in length.
 - b. Flexible conduit from outlet box to flush mounted lighting fixture shall not exceed 6 feet in length.
 - c. Maintain ground continuity through flexible conduit with green equipment grounding conductor; do not use flexible conduit for ground continuity.
 - d. Flexible conduit installed within plenum spaces shall be limited to lengths not exceeding 4 feet.
 - e. Liquid tight flexible conduit shall be used to connect equipment in exterior, damp or wet locations.
 7. All conduit from the fire pump controller to the fire pump shall be either galvanized rigid steel (GRS) or liquid tight flexible conduit.
- C. Below Grade Raceway Installations
1. Install top of conduits 2 inches minimum below bottom of building slabs.
- D. Raceway Installations within Concrete
1. Conduit shall be run following the most direct route between points.
 2. Conduit shall not be installed in concrete.
 3. Conduits shall not be installed within shear walls unless specifically indicated on the drawings. Conduit shall not be run directly below and parallel with load bearing walls.
 4. Protect all conduits entering and leaving concrete floor slabs from physical damage during construction.
 5. Provide expansion fittings in all conduits that pass through building expansion joints.

3.02. PULL BOXES

- A. Pull boxes shall be secured, independent of the conduit entries into the box. Pull boxes shall be secured to the building structure. In ceiling applications, pull boxes shall not be supported with ceiling wires.

- B. Conduits entering pull boxes shall connect to pull boxes using die-cast zinc connectors.
- C. Pull boxes shall be free from burrs, dirt and debris.

3.03. MAINTENANCE HOLES/HANDHOLES

- A. Maintenance holes/handholes shall be installed on a base of pea gravel at least 12 inches deep.
- B. Tops of maintenance holes/handholes shall be level with the existing grade.
- C. Ducts should enter as perpendicular to the wall surface as possible.
- D. Maintenance holes shall be grounded with four 3/4 inch diameter by 8 foot long ground rods, one driven inside of the maintenance hole at each corner. Connect the ground rods and any duct bank ground conductors together with a No. 4/0 AWG bare, stranded copper ground wire loop. A No. 2 AWG bare stranded copper pigtail from the ground wire loop shall be used to ground the maintenance hole cover frame, ladder support bracket, any metallic concrete inserts and metallic cable racks, and the shields of any cables that are spliced in the maintenance hole.

3.04. CONDUIT PLUGS/CAPS

- A. Protect conduits against dirt, plaster, and foreign debris with conduit plugs. Plugs shall remain in place until ready for use.
- B. Simplex, triplex or quadplex duct plugs shall be installed in conduits to house and seal cables.

3.05. ADDITIONAL REQUIREMENTS FOR INTERIOR LOW VOLTAGE CONDUITS

- A. Conduit runs shall not have more than two (2) 90-degree bends between pull points.
- B. Communications conduit system shall contain no condulets (also known as an LB).
- C. Rigid metal conduit (RMC) or intermediate metal conduit (IMC) shall be used for entrance conduits that exceed 50 feet into the building.
- D. Horizontal Conduits
 - 1. Support horizontal conduits at intervals not exceeding ten feet and within three feet of each outlet, junction box, backboard, enclosure or cabinet. Support conduits from structural steel members with spring steel type or beam conduit clamps and to non-metallic structural members with one-hole conduit straps. For exposed conduits and where conduits must be suspended below structure, single conduit runs shall be supported from

structure by hanger rod and conduit clamp assembly, and multiple conduits shall be supported by trapeze type support suspended from structure. Do not attach conduits to ceiling suspension system channels or suspension wires.

2. Conduits run through warehouse areas are to be mounted to the bottom chord of the roof joists.
3. For runs that total more than 100 feet in length, insert pull boxes so that no segment between boxes exceeds the 100 feet limit.
4. Each horizontal home-run conduit can serve from one (1) to three (3) outlet boxes. For one (1) outlet box, a 3/4" conduit shall be used, minimum. For two (2) outlet boxes, a 1" conduit shall be used, minimum. For three (3) outlet boxes, a 1-1/4" conduit shall be used, minimum.

3.06. REQUIREMENTS FOR OUTSIDE PLANT LOW VOLTAGE CONDUITS

A. Duct Banks

1. Duct banks shall be sloped downward toward maintenance holes/ handholes and away from buildings a minimum of 6 inches per 100 feet. Duct banks shall not route water from maintenance holes/ handholes into buildings. Duct banks shall not contain traps between maintenance holes/handholes where water may accumulate.
2. Where power and communications duct banks run in parallel, they shall be separated by a minimum of 12 inches.
3. Where duct banks enter maintenance holes or buildings, they shall be constructed as integral to the wall.
4. Duct bank shall extend to the inside surfaces of the walls, and the duct bank reinforcing shall be integrated with the wall reinforcing.
5. Bell ends shall be provided on ducts where the ducts enter maintenance holes or buildings.
6. Direct buried ducts and fittings shall have bend radii greater than the minimum bend radii of the cables enclosed, and shall not be smaller than the radii of standard manufactured elbows.
7. Direct buried ducts shall be installed parallel to or at right angles to building lines and site features, and as close to curbs and sidewalks as possible to avoid interferences with future landscaping.
8. Where direct buried PVC ducts cannot be buried deep enough to meet the NEC minimum cover requirements, rigid steel conduits shall be installed instead, or a concrete cover shall be poured over the ducts.

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SECTION 16120

CONDUCTORS

PART 1 GENERAL

1.01. GENERAL REQUIREMENTS

- A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 16000 - Electrical General.

1.02. WORK INCLUDED

- A. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install conductors, complete, as indicated on the Drawings and as specified herein. Provide a complete system of wiring with all feeders and branch circuits as shown on the Drawings. The wiring system shall be complete to each and every outlet and apparatus shown on the Drawings which requires electrical connections.
- B. This section includes wires, cables, and connectors for power, lighting, signal, control and related systems rated 600 volts or less.

1.03. COLOR CODING

- A. Color coding shall be as follows:

120/208 Volt System	277/480 Volt System
Phase A –Black	Phase A - Brown
Phase B – Red	Phase B - Orange
Phase C – Blue	Phase C - Yellow
Neutral – White	Neutral - Gray
Ground – Green	Ground - Green
Isolated Ground - Green with yellow strip (where applicable)	

(Verify color-coding with local code Authority and use local code requirements if and only if the above color code is not acceptable to local authority.)

- B. All wire shall be color coded throughout its entire length. Colored phase tape is not allowed.

PART 2 PRODUCTS

2.01. MANUFACTURERS

- A. Acceptable Manufacturers: Wire shall be Southwire/SIMpull™, Pirelli, Rome, General Cable, Senator, United Copper Industries, Alcan, AFC, or approved equal.

2.02. CONDUCTORS

- A. Conductor Material: Unless noted otherwise, conductors shall be copper, 98.5% conductivity except where specifically noted otherwise on Drawings.
- B. All wire and cable for feeders and branch circuits shall have copper conductors and shall be 600 volts, 90 degrees C, NEC type conductors with THHN/THWN-2 insulation.
- C. Wire No. 8 AWG and larger shall have stranded conductors. Wire No. 10 AWG and smaller shall be solid conductor type.
- D. No conductor shall be smaller than No. 12 AWG unless otherwise specified or noted.
- E. Branch circuit wiring which supplies more than one fluorescent fixture through the wiring of other fixtures shall be high temperature wire approved for such use.
- F. Pulling lubricant is neither required nor allowed for Southwire/SIMpull™ conductors.

2.03. ALUMINUM CONDUCTORS

- A. Where substituted for copper conductors, aluminum conductors shall match or exceed copper ampacity. Substitution shall be for feeders larger than 100 Amps. Minimum size aluminum conductors shall be #2/0AL. Aluminum feeder substitutions shall be sized for the equivalent ampacity of the specified copper feeder. It shall be the responsibility of the contractor to provide the required conduit size per NEC.
- B. Aluminum conductors shall be compact, Alcan, or Southwire. Conductors shall be AA-8000 series.
- C. Aluminum conductors shall not be used for branch circuits, and shall not be installed to any vibrating equipment (e.g. mechanical equipment, transformers, elevators, fire pumps).

- D. Mechanical screw-type connectors shall comply with the following:
1. Connectors shall be dual rated (AL7CU or AL9CU) and listed by UL for use with aluminum and copper conductors and sized to accept aluminum conductors of the ampacity specified.
 2. Using a suitable stripping tool, to avoid damage to the conductors, remove insulation from the required length of the conductor.
 3. Wire brush the conductor and apply a listed joint compound.
 4. Tighten the connection per the connector manufacturer's recommendation.
 5. Wipe off any excess joint compound.
- E. For connection to aluminum bus, the following hardware shall be used:
1. Bolts: Anodized alloy 2024-T4 and conforming to ANSI B18.2.1 and to ASTM B211 or B221 chemical and mechanical property limits.
 2. Nuts: Aluminum alloy 6061-T6 or 6262-T9 and conforming to ANSI B18.2.2.
 3. Washers: Flat aluminum alloy 2024-T4, Type A plain, standard wide series conforming to ANSI B27.2.
 4. Lubricate and tighten the hardware as per the manufacturer's recommendations.
- F. For connection to copper bus, the following hardware shall be used:
1. Bolts: Plated or galvanized medium carbon steel; heat treated, quenched and tempered equal to ASTM A-325 or SAE grade 5.
 2. Nuts: Heavy semi-finished hexagon, conforming to ANSI B18.2.2, threads to be unified coarse series (UNC), class 2B.
 3. Washers: Should be steel, Type A plain standard wide series conforming to ANSI B27.2.
 4. Belleville conical spring washers: shall be of hardened steel, cadmium plated or silicone bronze.
 5. Lubricate and tighten the hardware as per the manufacturer's recommendations.
- G. Aluminum conductors shall not be used where expressly forbidden by the local electrical inspections department or plan review board of jurisdiction. The electrical contractor shall verify this requirement prior to bid.

- H. Aluminum conductors shall not be connected to equipment which is not UL Listed for aluminum.

2.04. METAL CLAD “MC” CABLE

- A. Where allowed by the authority having jurisdiction, the use of metal clad cable is permitted as described below and shall meet all the requirements of the following codes and standards:
 - 1. Underwriters Laboratories Inc. 83, 1479, 1569, and 1581
 - 2. National Fire Protection Association NFPA 70, Article 330
 - 3. All local codes and municipal ordinances.
- B. The conductors of the metal clad cable shall comply with Articles 1.03 and 2.02 of this same section.
- C. MC cable shall be limited to branch circuits concealed in walls or above ceilings. Unless noted otherwise, metal clad cable may not be run directly into surface-mounted panels, cabinets, switches or other devices. All circuit homeruns shall be installed in conduit and shall be routed from the panelboard to the first branch circuit device.
- D. MC cable shall not be allowed for wiring to mechanical equipment.
- E. Unless noted otherwise, the metal clad cable shall be MC with a galvanized steel jacket, a Mylar assembly covering tape, rated at 90 degrees centigrade, with either a green insulated grounding conductor or MCAP Type MC cable with interlocked armor that is listed and identified for grounding, and rated for a maximum of 600 volts.
- F. Refer to National Electrical Code Article 330 for uses not permitted.
- G. Cables installed in other than vertical runs through bored or punched holes in wood or metal framing members, or through notches in wooden framing members and protected by a steel plate at least 1/16 inches thick, shall be considered supported and secured where such support does not exceed six (6) feet intervals.
- H. Cables containing four or fewer conductors sized not larger than No. 10 AWG shall be secured within 12 inches of every box, cabinet, fitting or other cable termination.
- I. Metal clad cable shall not be installed outside the building.

2.05. ACCESSORIES

- A. Wire Joints: T & B “Sta-Kon,” Scotchlok Type “R,” Ideal No. 452 or 453, or Buchanan “B-Cap.”

- B. Cable Connectors: Solderless Type O.Z. "circular clamp type" or T & B "lock-tite" appropriate for the particular application involved.

PART 3 EXECUTION

3.01. PREPARATION

- A. Lubricant: No grease, oil or lubricant other than powdered soapstone or approved pulling compound shall be used to facilitate the pulling of wires. Lubricant shall not be used for conductors with SIMpull™ insulation.

3.02. INSTALLATION

- A. Complete electrical systems shall be provided as shown on the Drawings and/or as specified herein.
- B. Wires shall be pulled without excessive strain to prevent damage to conductor or insulation. Provide pull boxes as required to facilitate pulling of wire.
- C. Prior to energizing, all service and feeder cables shall be tested with megohm meter to determine insulation resistance levels. Test report shall be submitted to the Engineer.
- D. Each raceway indicated by symbol on Drawings shall contain three (3) No. 12 AWG wires unless otherwise noted, scheduled or indicated. Hatch marks on raceway symbols indicate the number of conductors in a raceway when the number exceeds three (3).
- E. At each fixture or device outlet, a loop or end of wire not less than 6" long shall be left for connection to fixture or device.
- F. Splices, taps and connections shall be made up as follows:
 - 1. Wire sizes No. 10 AWG and smaller with wire nuts.
 - 2. Wire and cable of sizes No. 8 AWG and larger, with insulated mechanical or crimped connectors.
- G. Perform conductor tests as described in Section 16000 - Electrical General.
- H. One year after substantial completion, all aluminum conductor terminations shall be checked for proper torque and examined for visible signs of excessive heating. A report shall be provided to the Owner of the findings.

END OF SECTION 16120

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SECTION 16130

OUTLET BOXES AND JUNCTION BOXES

PART 1 GENERAL

1.01. GENERAL REQUIREMENTS

- A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 16000 - Electrical General.

1.02. WORK INCLUDED

- A. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install outlet and junction boxes, complete, as indicated on the Drawings and as specified herein.
- B. Equipment schedules and specifications are based on the one manufacturer listed in the schedule. Other manufacturers of equal quality and performance may be submitted to the Engineer for review. When substitution of equipment is made the Contractor shall be responsible for the costs of any item and engineered and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

1.03. QUALITY ASSURANCE

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.
- C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.
- G. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's

standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

1.04. JOB CONDITIONS

- A. Protection: Anchor boxes securely to formwork. Provide necessary protection to prevent entry of concrete.
- B. Sequencing, Scheduling: Locations of outlets shown on the Drawings are relative and approximate. Exact locations shall be determined on the job and the outlets accurately set according to the architectural drawings, dimensions, casework kneespace, building conditions, furniture positions and Architect's direction. The right is reserved to change the exact location (10'-0" or less) of any switch, ceiling outlet or other outlet in any room before it is permanently installed without increase in Contract cost.
- C. All outlet boxes and junction boxes shall be accessible. Any boxes in non-accessible areas (furred ceilings) shall be set flush with barrier surface at a location approved by the Architect.

PART 2 PRODUCTS

2.01. MANUFACTURERS

- A. Acceptable Manufacturers: National Electric Products Company, Thomas & Betts/Steel City, Appleton or Raco.

2.02. OUTLET BOXES

- A. Standard Outlet Boxes: Boxes and covers shall be galvanized steel not less than 1/16" thick and in every instance, of such form and dimensions as to be adapted to its specific use and location, kind of fixtures to be used and number, size and arrangement of conduits connecting thereto and particularly sized to accommodate the number and size of wires to be contained therein.
- B. Ceiling outlet boxes shall be 1-1/2" or 3-3/8" deep, 4" octagonal (or 4" square when required due to number of wires). Plaster rings or device covers need not be provided on ceiling boxes. Provide extension rings on ceiling boxes to accommodate number of conductors in box.
- C. Wall outlet boxes for toggle switches and convenience outlets shall be 1- 1/2" or 2-1/8" deep, 4" or 4-11/16" square. Provide with single-device covers (or two-device covers where needed). Covers shall be raised type to compensate for thickness of plaster or gypsum board wall finish. Refer to details on drawings for additional information and requirements.

- D. Outlet boxes for telecommunication purposes (telephone, data, etc.) shall be 4" x 4" square, 2-1/8" deep. Provide with single device covers (or two- device covers where needed). Covers shall be raised type to compensate for thickness of plaster or gypsum board wall finish. Refer to details on drawings for additional information and requirements.
- E. Junction boxes shall be as specified for ceiling and wall outlet boxes. Provide flat covers on ceiling outlets to match ceiling finish. Provide blank device type coverplates on wall outlets, of same materials as specified for device coverplates in same room or area.
- F. Outlet boxes where exposed rigid conduit is used shall be cast ferrous alloy, galvanized or cast aluminum.
- G. Covers: Where outlet boxes are to be capped, blank brushed stainless steel coverplates shall be used.
- H. Barriers: Provide barriers between devices operating at different voltages or on separate systems such as normal, critical, or life safety.

2.03. FLOOR BOXES

- A. Product Description
 - 1. Floor boxes for receptacles and telephone/data outlets shall be rectangular, non-metallic PVC. Boxes shall be suitable for use in slab-on-grade or above grade. Boxes shall include a non-metallic concrete cover to prohibit concrete or debris from entering the box during installation.
 - 2. Provide number of compartments as indicated on drawings.
 - 3. Coverplates and flanges shall be brass.
 - 4. Floor box device covers shall meet UL 514C requirements for scrubwater test standards.
- B. Manufacturer
 - 1. Hubbell PFBRG Series
 - 2. Walker/Wiremold 880MP Series
 - 3. Thomas & Betts 640P Series

2.04. PULL AND JUNCTION BOXES

- A. Pull and Junction boxes are not completely indicated. They shall be sized and installed where required in accordance with the NEC.
- B. Pull and Junction boxes shall be the suitable NEMA type number to match the environmental conditions.

- C. Locations of concealed pull and junction boxes shall be indicated on the record as built drawings for Owner's record.

2.05. CABINETS, FITTINGS, BOXES: GENERAL

- A. Cabinets shall be in accordance with UL 50, "Electrical Cabinets and Boxes" and NEMA 250, Type 1. Electrical cabinets, boxes and fittings shall be as required for types, sizes, and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for the use and location. Provide all items complete with covers and accessories required for the intended use. Provide gaskets for units in damp or wet locations.
- B. Construction shall be sheet steel, NEMA 1 class except as otherwise indicated. Cabinets shall consist of a box and a front consisting of a 1- piece frame and a hinged door. Arrange door to close against a rabbet placed all around the inside edge of the frame, with a uniformly close fit between door and frame. Provide concealed fasteners, not over 24" apart, to hold fronts to cabinet boxes and provide for adjustment. Provide flush or concealed door hinges not over 24" apart and not over 6" from top and bottom of door. For flush cabinets, make the front approximately 3/4" larger than the box all around. For surface mounted cabinets make from same height and width as box. Furnish metal barriers to separate wiring of different systems and voltage, and furnish accessory feet where required for freestanding equipment.
- C. Fasteners for general use shall be corrosion resistant screws and hardware including cadmium and zinc plated items.
- D. Fasteners for damp and wet locations shall be stainless steel screws and hardware.
- E. Exterior finish shall be gray baked enamel for items exposed in finished locations except as otherwise indicated.
- F. Painted interior finish, where indicated, shall be white baked enamel.
- G. Provide NEMA 3R or 4X for all exterior applications. Provide weatherproof gasketing for all covers and doors.
- H. Fittings for boxes, cabinets, and enclosures shall be in accordance with UL 5148 and shall be zinc plated steel for conduit hubs, bushings and box connectors.

2.06. UNDERGROUND PULL/JUNCTION BOXES

- A. Unless noted otherwise, underground enclosures shall be fiberglass, open-bottom and sloped-wall. Covers shall be polymer concrete. Boxes shall be

installed in areas expected to experience only light incidental, non-deliberate vehicular traffic (including that from mowers).

- B. Enclosures shall meet the load requirements and three-point test procedures specified in the industry standard ANSI SCTE 77 2007. Enclosures shall meet the Tier 8 cover load test (for light traffic) of 12,000 lbs. over a 10" x 10" plate.
- C. Manufacturer's guidelines shall be followed for installation, including 6" gravel bed beneath box for stability and drainage. Concrete collar shall be poured around enclosure to protect the ring and top from impact due to soil erosion.
- D. Where installed for pole lights, locate within 18" of the pole base or in landscaped areas.
- E. Manufacturer
 - 1. Highline Products
 - 2. OZ-Gedney

PART 3 EXECUTION

3.01. INSPECTION

- A. The location of all wall outlets, including light fixtures, receptacles, switches, etc., shall be checked to see that the outlet will clear any wall fixture, shelving, work tables, sinks, baseboard and fin type convectors, bulletin boards, etc., that will be installed.
- B. Exact locations of outlet boxes shall be coordinated with other trades so that outlet will not be covered by ductwork, piping, etc.
- C. The approximate locations of outlets are indicated on the Drawings. The exact locations shall be determined at the building. The right is reserved to change, without additional cost, the exact location of any outlet, a maximum of 10' before it is permanently installed.

3.02. PREPARATION

- A. Architectural Placement: Outlets occurring in architectural features shall be accurately centered in same. Space wall switch outlets equidistant from door trims on the strike side of doors as actually installed so that coverplate clears trim. Orientation of outlet boxes (horizontal or vertical) shall be as indicated on architectural elevations.
- B. Install all outlet boxes in finished areas flush with wall or ceiling finish. Maintain 1/4" or less space between outlet box front and finish wall surface.

- C. All switches at same level shall be installed on one horizontal line as shown on the Drawings.
- D. Wall mounted controls, including temperature controls, in a room shall be grouped at the same location and at same mounting heights.

3.03. INSTALLATION

- A. At all concealed outlets for electric lights, switches, wall receptacles, etc., standard outlet boxes and plaster rings shall be provided.
- B. Outlet boxes shall be firmly anchored in place and shall be provided with approved fixture studs where required. Outlet boxes shall not depend on the coverplate to hold it secure to the wall.
- C. Boxes on opposite sides of walls or partitions: Where drawings show back-to-back wiring devices, the devices on opposite sides of the wall shall be offset a minimum of 6". Through-the-wall type boxes shall not be used. Where boxes will be located on opposite sides of walls or partitions located 24" or closer to each other, moldable putty pads shall be installed to completely cover the exterior surfaces of the box within the stud cavity with a ball of putty material used to plug the end of each conduit at its connection to the box. These pads shall be of the CLIV type and manufactured by one of the following manufacturers:
 - 1. Minnesota Mining and Manufacturing Co.
 - 2. Nelson Firestop Products
 - 3. Specified Technologies, Inc.
- D. All holes cut through new or existing smoke or fire partitions shall be sealed. Sealant shall be 3M Brand Fire Barrier System or approved equal. Seals shall be installed in accordance with manufacturer's recommendations.
- E. All flush boxes in rated walls that are larger than 16 square inches in area shall be backed as follows: 1-hour wall - 1 layer of 5/8" gypsum board; 2- hour rated wall - 2 layers of 5/8" gypsum board. Gypsum shall be fire code and attached to outside surfaces of box(es).
- F. Cast aluminum, threaded hub type boxes with gasketed weatherproof covers shall be used for wet locations where box is surface mounted.
- G. Location of floor boxes indicated is approximate. The Contractor shall refer to the final layout or request field instructions for the exact location. Consult the Architect prior to installation.

END OF SECTION 16130

SECTION 16140

WIRING DEVICES

PART 1 GENERAL

1.01. GENERAL REQUIREMENTS

- A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 16000 - Electrical General.

1.02. WORK INCLUDED

- A. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install wiring devices, complete, as indicated on the Drawings and as specified herein.
- B. Equipment schedules and specifications are based on the one manufacturer listed in the schedule. Other manufacturers of equal quality and performance may be submitted to the Engineer for review. The following manufacturers are allowed:
 - 1. Hubbell
 - 2. Pass & Seymour
 - 3. Cooper
 - 4. Leviton
 - 5. Thomas & Betts/Steel City
 - 6. Walker/Wiremold

When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

- C. This section includes receptacles, connectors, switches, dimmers, timeclocks and coverplates.

1.03. QUALITY ASSURANCE

- A. Wiring devices shall comply with applicable sections of NEMA Standard WD-1, NFPA 70, Article 100.
- B. All special purpose receptacles shall be NEMA standard configuration.
- C. Comparative devices by acceptable manufacturers are equal.

PART 2 PRODUCTS

2.01. WIRING DEVICE DESCRIPTION AND MANUFACTURER

- A. Single & Duplex Receptacles (20 Amp)
 - 1. Single or duplex type receptacle as indicated. 125V/20A/2P/3W/G rating - NEMA - 5-20R type.
 - 2. Face color shall be selected by the Architect (red where on emergency circuit).
 - 3. Manufacturer
 - a. Hubbell 5362
- B. GFCI Duplex Receptacles
 - 1. Duplex, feed-thru type ground fault current interrupter receptacle with test/reset buttons. 125V/20A/2P/3W/G rating - NEMA 5-20R type conforming to UL #498, UL #943 Class A and NEMA #WD1- 4.02.
 - 2. Manufacturer
 - a. Hubbell GF20 Series
- C. Isolated Ground Single & Duplex Receptacles
 - 1. Single or duplex type receptacles as indicated. 125V/20A/2P/3W/IG rating - NEMA 5-20R type ground internally isolated from receptacle frame and ground pigtail or terminal screw.
 - 2. Manufacturer
 - a. Hubbell IG5352
- D. Clock/Flat Screen Receptacles
 - 1. Single type receptacle with a recessed outlet clock hanger type mounting coverplate. 125V/15A/2P/3W/G - NEMA 5-15R type.
 - 2. Manufacturer
 - a. Hubbell RR151CH Series
- E. Maintained Contact Switches
 - 1. Provide toggle operated switches SPST, DPST, 3-way or 4-way operation as indicated. 277V/20A rating, quiet type, maintained contact, and a green hexagonal ground screw or ground pigtail, and side wired.

2. Manufacturer
 - a. Hubbell 1221 Series (Color to match receptacles).
- F. Momentary Contact Switches
 1. Provide toggle or key operated switches as indicated with single circuit, 3-position center-off operation. 277V/20A rating, quiet type, momentary contact, spring loaded switch, and green hexagonal ground screw or ground pigtail, back and side wired.
 2. Manufacturer
 - a. Hubbell HBL 155* (Color to match receptacle).
- G. Maintained Contact Slider Type Switch (For Multi-Ganging with Dimmers)
 1. Slide-operated switch (to match dimmer), single pole, 3-way or 4-way operation as indicated, 120/277V, 20A rating.
 2. Manufacturer
 - a. Leviton Monet Series
 - b. Lutron Nova T Series
- H. Slider Type Incandescent Dimmers
 1. Slide operated AC incandescent solid state type dimmer with positive ON/OFF switching, integral surge protection, voltage stabilized output, RFI filtered and maximum lighting level adjustment. 120V/60Hz, unless noted otherwise, with lettering and/or nameplate as indicated. Dimmers shall have lowest profile available (wattage permitting).
 2. Manufacturer
 - a. Leviton Monet Series
 - b. Lutron Nova T Series
- I. Illuminated Toggle Switches
 1. Single pole, 3-way or 4-way, as indicated, conforming to UL #20, NEMA #WDI-3.02 and F.S. #W-S-896E. 277V/20A rating, quiet type, maintained contact, and a green hexagonal ground screw or ground pigtail, back and side wired. Red colored toggle to glow when switch is on.
 2. Manufacturer
 - a. Hubbell HBL 1221PL

J. Weather-Resistant Receptacles

1. All 15- and 20-amp receptacles installed in damp or wet locations shall be listed weather-resistant type.

2.02. COVERPLATE DESCRIPTION AND MANUFACTURER - COVERPLATES

A. Flush Mounted Interior Receptacle/Switch Coverplates

1. Office Areas: Single or multi-gang to match device type. Medium size (4-7/8" min.), standard depth, smooth finish with nylon material.
2. Office Areas: Color to match device color.
3. Warehouse/Mechanical/Electrical equipment rooms and high abuse areas shall be brushed stainless steel, non-magnetic.
4. Manufacturer
 - a. Hubbell NPJ Series (nylon)
 - b. Hubbell SS Series (stainless steel)

B. Weatherproof Device Coverplates

1. Provide weatherproof "in use" cast aluminum lockable covers.
 - a. Hubbell WP Series
 - b. Thomas & Betts Russell Stoll Series

C. Multi-Outlet Raceway

1. Product Description
 - a. Two-piece rectangular surface raceway of length as prescribed. Stainless steel type 304 housing complete with all bends, fittings, couplings, caps and mounting hardware.
 - b. Single 15A/125V grounding outlets UL Labeled and full length ground wire.
 - c. Outlets 18" on centers starting no less than 9" from end.
 - d. Maximum of six outlets per circuit. Where two or more circuits are utilized the outlets shall be on alternate circuits.
2. Manufacturers
 - a. Walker/Wiremold
 - b. Hubbell

2.03. MISCELLANEOUS ITEMS

A. Time Switches

1. Electronic Astronomical Schedule Type

a. 365 day scheduling, solid state, skip-a-day feature, daylight saving changeover, leap year adjusted with capacitor backup, DPDT-120V/20A rated contacts, light sensor input.

b. Acceptable Manufacturer

1) Paragon #EL72 Series (channels as required)

B. Photoelectric Control Switches

1. Product Description

a. Raintight photoelectric self-contained control for switching.

b. Die-cast housing with adjustable sensor.

2. Manufacturers

a. AMF/Paragon

b. Tork 2100 Series

C. Lighting Contactor

1. Product Description

a. Multi-pole contactor for switching branch circuit tungsten and ballast lighting and resistant heating loads.

b. Number of poles as indicated (paralleling multiple contactors is acceptable), poles rated for 20 amperes @ 600V continuous duty.

c. Mechanically held contactor with coil clearing contacts, operating coil voltage to match circuit characteristics.

d. Housed in panelboard (if indicated).

PART 3 EXECUTION

3.01. INSTALLATION

A. All dimmer circuits shall have dedicated neutrals.

B. Install devices and wall plates flush and level.

C. Coordinate the exact location of wiring devices with other trades and architectural features. Do not locate devices on two different architectural

finishes such as half on wall tile and half on painted surface, unless noted otherwise.

- D. Provide plaster rings in areas requiring them due to construction.
- E. Where more than one device is indicated, arrange in gangs covered with one coverplate per manufacturer's instructions.
- F. Where dimmer(s) and switch(es) are shown adjacent to one another, switch(es) shall be a maintained contact switch matching dimmer style, so that a common, multi-gang faceplate can be used.
- G. Provide 6" long ground wire from grounding lug to all switches and receptacles to a screw type bonding device on the conduit or outlet box.

END OF SECTION 16140

SECTION 16160

PANELBOARDS

PART 1 GENERAL

1.01. GENERAL REQUIREMENTS

- A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 16000 - Electrical General.
- B. Provide the panelboards indicated on the Drawings complete with overcurrent protection devices and spaces.
- C. This section includes panelboards and distribution panelboards and associated auxiliary equipment rated 600 V or less as shown on the drawings.
- D. Refer to panel schedule and one-line power diagram on drawings for specific requirements of each panel.

1.02. WORK INCLUDED

- A. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install panelboards, complete, as indicated on the Drawings and as specified herein.
- B. Equipment schedules and specifications are based on the one manufacturer listed in the schedule. Other manufacturers of equal quality and performance may be submitted to the Engineer for review. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

1.03. QUALITY ASSURANCE

- A. Panels shall be factory assembled.
- B. Coordination: Coordinate installation with architectural and structural features, equipment installed under other sections of the Specifications and electrical equipment to ensure panel access and so that clearance minimums are provided.
- C. Components and installation shall be in accordance with NFPA 70, "National Electrical Code," NEMA PBI, "Panelboards" and UL67 and UL50.
- D. Panelboards and load centers shall be listed and identified for use with 75 degrees C rated conductors.

1.04. SUBMITTALS

- A. Refer to Section 16000 - Electrical General for submittal requirements.
- B. Manufacturers Product Data:
 - 1. Submit material Specifications and installation data for products specified under Part 2 - Products to include:
 - a. Overcurrent protection devices
 - b. Panelboards
- C. Shop Drawings: Submit shop drawings to indicate information not fully described by the product data to indicate compliance with the Contract Drawings.
 - 1. Include electrical characteristics and ratings for each panelboard with dimensions, mounting, bus material, voltage, ampere rating, mains, poles and wire connection, and any accessories. Indicate method of ground bus attachment to enclosure.
 - 2. Include bussing diagram indicating each bussing overcurrent protection device position.
 - 3. Provide a schedule indicating overcurrent protection device type, trip and size, poles, frame type, interrupting capacity.
 - 4. Coordinate the lugs for all overcurrent devices, mains, etc. to accommodate the designed feeder(s) sizes.

PART 2 PRODUCTS

2.01. MANUFACTURERS

- A. Panelboard manufacturer shall be:
 - 1. Siemens
 - 2. Square D
 - 3. General Electric
 - 4. Cutler-Hammer
- B. Coordination panelboard manufacturer (fusible panelboards) shall be:
 - 1. Cooper Bussman

2.02. GENERAL REQUIREMENTS

- A. All panels and overcurrent protection devices shall be UL Listed and bear a UL Label. Where panel serves as service entrance equipment, panel shall bear a UL Label indicating suitability as service entrance equipment.
- B. Panels shall be of the dead front safety type.
- C. Provide panels complete with factory assembled circuit breakers or fuses connected to the bus bars in the positions shown on the panel schedules.
- D. Provide all panelboards fully rated to the A.I.C. ratings noted on the schedules, but not less than 10,000 amperes for 120/208 volt panelboards and not less than 14,000 amperes for 277/480 volt panelboards. All devices in a panelboard shall be rated for the A.I.C. ratings shown for the panelboard.

2.03. BUSSING AND INTERIORS

- A. All bus bars shall be aluminum. Main lugs and main overcurrent protection devices shall be UL approved for copper or aluminum conductors and shall be of a size range for the conductors indicated on the drawings. Each panel shall contain a full size grounding bus. All panelboards shall contain a full size insulated neutral bus unless otherwise indicated on the drawings.
- B. The neutral and ground bus shall have a sufficient number of lugs to singularly terminate each individual conductor requiring a connection.
- C. Where designated on panel schedule as "space," include all necessary bussing, device support and connections. Provide blank cover for each space.
- D. Where specified or indicated on the drawings, provide sub-feed lugs adjacent to the mains or feed-through lugs opposite end of mains and increase box heights to provide additional cable bending and termination space. Lugs to be the same size and capacity as mains and rated for aluminum or copper conductor terminations.

2.04. ENCLOSURES

- A. Panelboard width shall not be less than twenty inches unless indicated on the drawings (32" minimum for distribution panelboards).
- B. Provide concealed captive clamping devices, concealed hinges and chrome lock for all flush mounted panels. Key all panels throughout project alike.
- C. Where two section panels are required, both sections shall have fully rated bus, separate cabinets connected by conduit nipples. Interconnect sections with copper conductors with ampacity equal to rating of main bus. Route

phase and neutral conductors together between panels. Provide separate trims for each section.

- D. Panelboard trims for surface mounted panelboards shall be continuously hinged on one side so that when opened, wiring gutters are completely exposed.
- E. Provide a label for each branch circuit, feeder, and main circuit breaker in distribution panels, permanently attached per the requirements of Section 16000 – Electrical General, 2.02A.
- F. Cabinets, flush or surface mounted as indicated. NEMA PB-1, Type 1 enclosure, except where the following enclosure requirements are indicated:
 - 1. NEMA 250, Type 3R - Raintight.
 - 2. NEMA 250, Type 3S - Raintight and dust tight.
 - 3. NEMA 250, Type 4X - Corrosion-resistant stainless steel enclosure, watertight, dust tight, and resistant to oil and coolant seepage. This type shall be used in kitchen areas.
 - 4. NEMA 250, Type 12 - Dust tight, dripproof, and resistant to oil and coolant seepage.
- G. Enclosure shall be fabricated with galvanized steel. Trims shall have electrostatic applied ANSI gray enamel finish and adjustable indicating trim clamps for securing trim to the enclosure. Screwed-on trims shall not be acceptable. Trim shall have an angle support along the bottom serving as a support between trim and enclosure for safe installation and removal of trim.
- H. Exterior Panels: Panelboards mounted outside of building shall be in NEMA type 3R enclosures. Panelboards shall have in addition to the standard specified items the following:
 - 1. Piano hinge
 - 2. Seams continuously welded
 - 3. Rolled lip around door and cabinet
 - 4. No knockouts or holes
 - 5. Neoprene gaskets on inside of door
 - 6. Stainless steel hardware
 - 7. Drip hood at top above door

2.05. CIRCUIT BREAKERS

- A. Interrupting rating of all circuit breakers in panelboards shall have UL rating of not less than the RMS symmetrical amps indicated on the Drawings at system voltage. Series rated devices are acceptable with the following exceptions: devices used in distribution serving emergency, standby and multiple elevator loads (selective coordination).
- B. Circuit breakers shall be provided with trip rating and poles as indicated on the drawings or specified herein.
- C. Multi-pole breakers shall be common trip and common reset; tie handle connection between single pole breakers is not acceptable.
- D. Branch circuit breakers in lighting and appliance panels shall be quick-make, quick-break, thermal magnetic type bolted to the bus. Circuit breakers in distribution type panel boards shall be bolted to the bus.
- E. Provide the following special devices and accessories when indicated on the drawings or specified herein.
 - 1. Ground fault interrupting circuit breakers (GFI) where indicated on the drawings.
 - 2. Provide handle lock-off device to prevent manually turning off device without removal. Install on all circuit breakers indicated on the panel schedule.
 - 3. Provide UL Listed "SWD" switching duty circuit breakers on the devices indicated on the drawings.
 - 4. Provide shunt trip device for electrically tripping circuit breakers indicated on the drawings.

2.06. FUSIBLE COORDINATION PANELBOARDS

- A. Interrupting rating of all fuses in panelboards shall have UL rating of not less than the RMS symmetrical amps indicated on the Drawings at system voltage.
- B. Fusible panelboards shall be listed to UL 67.
- C. Furnish 10% or minimum of three fuses of each rating and type of fuse installed, in addition to any spares indicated in schedule.
- D. Panelboard overcurrent device interrupting ratings shall be fully rated for the maximum available fault current and have a U.L. listed interrupting rating of 300kA and CSA certified interrupting rating of 200kA.

- E. Panelboard circuits 100A and less shall incorporate overcurrent protection and branch-circuit disconnecting means into a single integrated component.
- F. Interiors shall be factory assembled.
- G. Panelboard shall be equipped with a six-space spare fuse compartment for storing replacement branch circuit fuses.
- H. Bus bars shall be tin-plated copper.
- I. Neutrals shall be fully rated.
- J. Where equipped with main disconnect, permanently installed lockout means shall be provided on the disconnect for lockout tag procedures.
- K. Main disconnect shall be quick-make, quick-break type.
- L. Main and Branch Overcurrent Protection
 - 1. All overcurrent protective devices shall have a minimum U.L. listed interrupting rating of 300kA and CSA Certified interrupting rating of 200kA.
 - 2. Main overcurrent protective devices shall be 600Vac UL Listed minimum 300kA IR and CSA Certified minimum 200kA IR Class J time-delay fuses or Class J performance fuses.
 - 3. Branch circuit overcurrent protection shall be 600Vac UL Listed minimum 300kA IR and CSA Certified minimum 200kA IR finger- safe fuse with Class J performance fuses.
 - 4. Where panelboard main fuses are installed, fuses in panelboard branch circuits shall selectively coordinate with main fuses for all overcurrents up to 200kA.
- M. Branch fused disconnects
 - 1. Device shall have visible ON/OFF indication with colored and international symbol markings.
 - 2. Device shall provide open fuse indication permanently installed neon indicating light.
 - 3. Device shall be UL and cUL Listed 600Vac/200kA or 125Vdc/ 100kA voltage/short-circuit current rating, load-break disconnect with amp ratings and number of poles as indicated on the panelboard schedule.
 - 4. Fuse and disconnect assembly shall be a finger-safe component with trim installed.
 - 5. Fuse and disconnect shall be interlocked to disallow fuse removal while fuse terminals are energized.

6. No special tools shall be required for fuse removal.
7. Devices shall have bolt-on style bus connectors.
8. Device housing shall be clearly marked with device amperage.
9. Device shall provide fuse amp rating rejection at the following ampacities to ensure continued circuit protection at the specified circuit rating: 15A, 20A, 30A, 40A, 50A, 60A, 70A, 90A and 100A.

PART 3 EXECUTION

3.01. INSTALLATION

- A. Provide from each flush mounted panelboard four (4) 3/4" empty conduits stubbed out above ceiling line and capped or in exposed areas above bottom chord of joist.
- B. Install panelboards in accordance with NEMA PB1.1, "General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less" and manufacturer's written installation instructions.
- C. Mount panelboards with top circuit breaker not more than 6'-6" above finished floor.
- D. Only one conductor installed under terminal of individual circuit breakers. Form and train conductors in panel enclosure neatly parallel and at right angles to sides of box. Un-insulated conductor shall not extend beyond one-eighth inch from terminal lug.
- E. Do not splice conductors in panels. Where required, install junction box adjacent to panel and splice or tap conductors in box.
- F. Mounting and Support
 1. Mounting
 - a. Enclosure shall be secured to structure by a minimum of four (4) fastening devices. Panelboards 600 amp and larger shall be secured by a minimum of eight (8) devices. A 1.5 inch minimum diameter round washer shall be used between head of screw or bolt and enclosure.
 - b. Enclosures shall be mounted where indicated on the drawings or specified herein. Support from the structure with fastening device specified.
 - c. Attach enclosure directly to masonry, concrete, or wood surfaces.

- d. Mounted enclosure on metal channel (strut), which is connected to structure with fastening device specified, for installation on steel structure or sheet rock walls.
- G. Maintain conductor phase color code requirements described in the conductors and cables section of the specifications.
- H. A typewritten branch circuit directory (based on as-built conditions) shall be provided for each panelboard and load center, permanently mounted on inside of door in a transparent, protective cover. Room number(s) or room name(s) shall be included in the circuit description in coordination with the final naming/numbering scheme for the project (e.g. "Office Receptacles" shall read "Office Receptacles – Rm. 202, 203"). Provide electronic copy of all circuit directories to the Owner.
- I. Install panelboard ground fault circuit interrupter devices in accordance with installation guidelines of NEMA 289, "Application Guide for Ground Fault Circuit Interrupters."
- J. Tighten electrical connectors and terminals, including grounding connections, in accordance with manufacturer's published torque- tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- K. Mounting of all panelboards and all hardware used for mounting shall be in accordance with the seismic criteria per the applicable building code.
- L. Fusible coordination panelboards shall be shipped without branch circuit fuses installed. Branch circuit fuses shall be shipped separately with the chassis. Where main fuses are specified 100A or greater, equipment shall be shipped with main fuses installed.

END OF SECTION 16160

SECTION 16170
DISCONNECT SWITCHES

PART 1 GENERAL

1.01. GENERAL REQUIREMENTS

- A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 16000 - Electrical General.

1.02. WORK INCLUDED

- A. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install disconnect switches, up to 1200 amps, complete, as indicated on the Drawings and as specified herein.
- B. Equipment schedules and specifications are based on the one manufacturer listed in the schedule. Other manufacturers of equal quality and performance may be submitted to the Engineer for review. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.
- C. This section includes fuses.
- D. This section includes individually mounted enclosed switches used for the following:
 - 1. Service disconnecting means.
 - 2. Feeder and branch-circuit protection.
 - 3. Motor and equipment disconnecting means.

1.03. SUBMITTALS

- A. Product Data: For each type of switch and fuse accessory, and component indicated, include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.

1.04. 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. Comply with NEMA AB 1, NEMA KS 1 and UL 98.

- C. Comply with NFPA 70.
- D. Comply with NEMA FU 1.
- E. Source Limitations: Provide fuses from a single manufacturer.

1.05. COORDINATION

- A. Coordinate layout and installation of switches and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 PRODUCTS

2.01. MANUFACTURERS

- A. Manufacturer of fusible and non-fusible switches shall be Cutler-Hammer, General Electric, Siemens or Square D Company.
- B. Manufacturer of fuses shall be Bussman, Gould Shawmutt or Littelfuse.

2.02. ENCLOSED SWITCHES

- A. All disconnect switches shall be heavy duty type with lockable handles.
- B. Enclosed, non-fusible switch: NEMA KS 1.
- C. Enclosed, fusible switch, 800 A and smaller: NEMA KS 1 with clips to accommodate specified fuses and interlocked with cover in closed position.
- D. Furnish and install all safety type disconnecting switches indicated on the drawings, specified or required by the National and/or State Electrical Code. Switches shall be externally operable. If the size is not shown on the drawings, the subcontractor shall size the disconnect switch in accordance with name plate data of the equipment they serve.
- E. Coordinate with other trades that may provide unit mounted disconnect switches prior to submission of bids.
- F. Safety type disconnecting switches shall be heavy duty, 600 volt industrial type with quick-make, quick-break mechanism and interlocking cover which normally cannot be opened when the switch is in the "ON" position. Switches shall be single throw. Fusible switches shall be equipped with fuse clips to receive Bussman fuses. Switches shall have provision for padlocking in the open and closed positions. The operating handle shall be visible in either the on or off position.
- G. All fused disconnect switches mounted above 6'-6" shall be hook stick operable.

2.03. INTERIOR

- A. Switch blades shall be operated by rotating shaft directly connected to the operating handle mechanism. Switch blades shall be clearly visible in the open position. All switches shall have clear shields over the incoming line lugs. Line shields shall be attached in such a way that switch blade covers or arc shields need not be removed for line installation. Line and load lugs shall be front removable and suitable for copper or aluminum, 60/75 degree wire through 200A sizes, 75 degrees C wire for 400-800A sizes.
- B. Current limiting type RK1 dual element time delay fuses shall be furnished and installed as necessary; rating shall be shown on drawing.

2.04. ENCLOSURES

- A. All switches shall have NEMA type 1 general purpose enclosures unless indicated otherwise on the drawings. NEMA 3R covers shall be side hinged rather than top hinged. NEMA 1 and 3R switches through 200A sizes shall tangential knockouts for conduit line up against walls. NEMA 12 enclosures through 200A sizes shall be UL Listed for conversion to NEMA 3R usage by opening a factory provided drain hole. All types of enclosures shall have metal nameplates affixed to the cover to show the switch type and rating and clearly indicate "ON" and "OFF" direction of handle movement. Provide hubs on all NEMA 4, 4X, or 3R type disconnects.
- B. Provide manufacturer's standard factory applied finish unless otherwise indicated.
- C. Provide phenolic engraved nameplate for disconnect switches.

2.05. CONTROL POLE

- A. Where required a direct action interlock or control pole shall be affixed to the switch base in such a manner as to operate positively and only with the opening and closing of the switch power poles.

2.06. CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

PART 3 EXECUTION

3.01. EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

- B. Examine elements and surfaces to receive enclosed switches for compliance with installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02. INSTALLATION

- A. Locate disconnect switches to provide working clearance and full accessibility as required by the National Electrical Code.
- B. Mounting and Support
 - 1. Mounting
 - a. Enclosure shall be secured to structure by a minimum of four (4) fastening devices. A 1.5-inch minimum diameter round washer shall be used between head of screw or bolt and enclosure.
 - b. Enclosure shall be mounted where indicated on the drawings or specified herein. Support from the structure with fastening device specified. Mount with operating handle at 60" AFF, unless other height is indicated.
 - c. Attach enclosure directly to masonry, concrete, or wood surfaces.
 - d. Mounted enclosure on metal channel (strut), which is connected to structure with fastening device.
 - e. Where enclosure is not indicated on a wall or structure, construct a metal channel (strut) free standing frame secured to floor, pad, or other appropriate building structure.
- C. Do not splice conductors in enclosure. Where required install junction box or wireway adjacent to enclosure and splice or tap conductors in box. Refer to number of conductors in a conduit limitation defined in the conductors and cables section of the Specifications and do not exceed.

3.03. CONNECTIONS

- A. Install equipment grounding connections for switches with ground continuity to main electrical ground bus.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04. CLEANING

- A. On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning.
- B. Touch up paint all scratched or marred surfaces with factory furnished touch up paint of the same color as the factory applied paint.

END OF SECTION 16170

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SECTION 16180
ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.01. GENERAL REQUIREMENTS

- A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 16000 - Electrical General.

1.02. WORK INCLUDED

- A. The work required under this section of the Specifications consists of installation of enclosed circuit breakers up to 800 amps for use on systems 600 volts and below as indicated on the drawings. This Section includes individually mounted enclosed circuit breakers used for the following:
 - 1. Service disconnecting means.
 - 2. Feeder and branch-circuit protection.
 - 3. Motor and equipment disconnecting means.
- B. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install enclosed circuit breakers, complete, as indicated on the Drawings and as specified herein.
- C. Equipment schedules and specifications are based on the one manufacturer listed in the schedule. Other manufacturers of equal quality and performance may be submitted to the Engineer for review. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

1.03. SUBMITTALS

- A. Product Data: For each type of circuit breaker accessory and component indicated, include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.

1.04. 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. Comply with NEMA AB 1, NEMA KS 1, UL 98, NEMA Standards Publication AB1-1975 and Federal Specifications W-C-375B classifications.

- C. Comply with NFPA 70.

1.05. COORDINATION

- A. Coordinate layout and installation of circuit breakers and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 PRODUCTS

2.01. MANUFACTURERS

- A. Manufacturer of enclosed circuit breakers shall be Cutler-Hammer, General Electric, Siemens or Square D Company.

2.02. CIRCUIT BREAKERS

- A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits.

2.03. ENCLOSURES

- A. NEMA 1 enclosures shall be fabricated from sheet steel with ANSI 49 gray baked enamel finish. Knockouts shall be provided in enclosures for circuit breakers through 225A frame sizes. Enclosures shall be provided with a means to padlock the circuit breaker in the OFF position.
- B. NEMA 3R enclosures shall be fabricated from galvanically treated steel with ANSI 49 gray baked enamel finish. Enclosures for circuit breaker through 225A frame sizes shall have provisions for interchangeable conduit hubs. Enclosures shall be provided with a means to padlock the plate-type cover closed.
- C. Provide manufacturer's factory applied finish unless otherwise indicated.
- D. Provide phenolic engraved nameplate for circuit breakers.

PART 3 EXECUTION

3.01. EXAMINATION

- A. Examine elements and surfaces to receive enclosed circuit breakers for compliance with installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02. INSTALLATION

- A. Locate enclosed circuit breakers to provide working clearance and full accessibility as required by the National Electrical Code.
- B. Mounting and Support
 - 1. Mounting
 - a. Enclosure shall be secured to structure by a minimum of four (4) fastening devices. A 1.5" minimum diameter round washer shall be used between head of screw or bolt and enclosure.
 - b. Enclosures shall be mounted where indicated on the drawings or specified herein. Support from the structure with fastening device specified. Mount with operating handle at 60" AFF, unless other height is indicated.
 - c. Attach enclosure directly to masonry, concrete, or wood surfaces.
 - d. Mounted enclosure on metal channel (strut), which is connected to structure with fastening device.
 - e. Where enclosure is not indicated on a wall or structure, construct a metal channel (strut) free standing frame secured to floor, pad, or other appropriate building structure.
- C. Do not splice conductors in enclosure. Where required install junction box or wireway adjacent to enclosure and splice or tap conductors in box. Refer to number of conductors in a conduit limitation defined in the conductors and cables section of the Specifications and do not exceed.

3.03. CONNECTIONS

- A. Install equipment grounding connections for circuit breakers with ground continuity to main electrical ground bus.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04. CLEANING

- A. On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

- B. Touch up paint all scratched or marred surfaces with factory furnished touch up paint of the same color as the factory applied paint.

END OF SECTION 16180

SECTION 16200

SWITCHBOARDS

PART 1 GENERAL

1.01. DESCRIPTION

- A. The work required under this section of the Specifications consists of the installation of all switchboards for use on systems 600 volts and below. All materials and devices which are an integral part of the switchboards shall be provided under this section of the Specifications.
- B. Switchboards as specified in these Contract Documents are free standing, dead-front, metal enclosed panels of one or more sections. The overcurrent devices may be individually or group mounted.

1.02. QUALITY ASSURANCE

- A. Acceptable Manufacturers: Products of the following manufacturers, which comply with these Specifications, are acceptable:
 - 1. Square D
 - 2. Siemens
 - 3. Cutler Hammer
 - 4. General Electric
- B. Equipment Dimensions
 - 1. Dimensions noted on the Drawings are the maximum allowable and shall not be exceeded. Where switchboard(s) of acceptable manufacturers listed exceed the maximum dimensions, products of such manufacturers shall not be acceptable.
- C. Coordination
 - 1. Coordinate installation with architectural and structural features, equipment installed under other sections of the Specifications and electrical equipment to ensure access and so that clearance minimums are provided.

1.03. SUBMITTALS

- A. Refer to Section 16000 - Electrical General for submittal requirements.
- B. Shop Drawings: Submit shop drawings to indicate compliance with the Contract Documents.

1. Include electrical characteristics and ratings for each switchboard with dimensions, mounting, bus material, voltage, bracing, ampere rating, mains, poles and wire connection, and any accessories.
2. Include bussing diagram indicating each circuit breaker or fused switch position.
3. Provide a schedule indicating overcurrent device, trip and size, poles, frame type, fuse size and type, or circuit breaker interrupting capacity.
4. Coordinate the lugs for all overcurrent devices, mains, etc. to accommodate the designed feeder(s) sizes.

1.04. SHORT CIRCUIT AND COORDINATION STUDY

- A. Overcurrent protective devices shall be selectively coordinated for distribution systems serving emergency and standby loads, as well as those serving multiple elevators, for faults with durations at 0.01 seconds.
- B. Manufacturer of switchboards and panelboards shall provide a short circuit and coordination study for:
 1. Distribution systems required to be selectively coordinated that contain circuit breakers.
 2. Distribution systems containing breakers with adjustable trip settings.
 3. Distribution systems requiring arc-flash analysis.
- C. Where required for selective coordination purposes, the coordination study shall be included in the shop drawing submittals for the equipment.

1.05. ARC FLASH SAFETY

- A. The Contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D, and IEEE 1584 – Guide for Performing Arc Flash Hazard Calculations.
- B. Arc Flash Hazard Analysis
 1. Manufacturer of switchboards and panelboards shall provide an arc flash hazard analysis for the electrical distribution system. Include this study in the shop drawing submittals for the equipment.
 2. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D.
 3. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and

coordination study model. Alternative methods shall be presented in the proposal.

4. The flash protection boundary and the incident energy shall be calculated and reported at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.
5. The arc flash hazard analysis shall include all MV, 575v, and 480v locations and locations in 240 volt and 208 volt systems rated 400 amps and above.
6. Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm².
7. The arc flash hazard analysis shall include calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
8. Arc flash computation shall include both line and load side of main breaker calculations, where necessary.
9. Arc flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2.
10. The report shall indicate incident energy and flash protection boundary calculations as follows:
 - a. Arcing fault magnitude
 - b. Device clearing time
 - c. Duration of arc
 - d. Arc flash boundary
 - e. Working distance
 - f. Incident energy
 - g. Hazard risk category
 - h. Recommendations for arc flash energy reduction

C. Arc Flash Warning Labels

1. Contractor shall field-install arc flash labels on equipment that includes the available incident energy and required personnel protective equipment (PPE).
2. The vendor shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.
3. The label shall have an orange header with the wording, "WARNING, ARC FLASH HAZARD," and shall include the following information:
 - a. Location designation
 - b. Nominal voltage
 - c. Flash protection boundary
 - d. Hazard risk category
 - e. Incident energy
 - f. Working distance
 - g. Engineering report number, revision number and issue date
4. Labels shall be machine-printed, with no field markings.
5. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings:
 - a. For each 600, 480 and applicable 208 volt panelboards and disconnects, one arc flash label shall be provided.
 - b. For each motor control center, one arc flash label shall be provided.
 - c. For each low voltage switchboard, one arc flash label shall be provided.
 - d. For each switchgear, one flash label shall be provided.
 - e. For medium voltage switches one arc flash label shall be provided.
6. Labels shall be field-installed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

D. Arc Flash Training

1. The equipment vendor shall train up to four (4) personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours). Maintenance procedures in accordance with the

requirements of NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces, shall be provided in the equipment manuals.

PART 2 PRODUCTS

2.01. GENERAL

- A. Furnish all materials specified herein.
- B. The switchboard, circuit breakers, and fused devices shall be UL Listed and bear the UL Label. Where a switchboard is utilized as service entrance equipment, it shall be UL Labeled as suitable for such use.
- C. The switchboard(s) shall be suitable for operation on the voltage system indicated on the Drawings.

2.02. STRUCTURE ARRANGEMENT

- A. The switchboard(s) shall consist of free-standing, standardized vertical sections bolted together to form a continuous structure.
- B. Adequate space for conduit and conductors entering the top or bottom, in accordance with the National Electrical Code, shall be provided without structural interference, conductors shall be safely accessible without disrupting service.
- C. The structure and all components shall be finished in the manufacturer's standard corrosive-resistant primer and coating.
- D. Unless noted otherwise, switchboard sections shall be front accessible.

2.03. BUS ARRANGEMENT

- A. All busses shall be tin-plated aluminum, rated for a 65 degrees C temperature rise above a 40 degrees C ambient. The minimum bus bracing, in RMS-symmetrical-amperes, shall be as shown on the Drawings.
- B. A neutral bus bar shall be provided, rated 100% of the main phase bus bar ampacity.
- C. The main bus shall be fully rated for the entire length of the switchboard.
- D. All non-current-carrying parts of the switchboard shall be grounded through the use of a continuous horizontal ground bus connected to vertical ground busses in each section. Ground bus rating shall meet or exceed the ampacity of the electrical service grounding electrode conductor(s).
- E. An accessible cable termination compartment shall be provided for incoming line termination for main lug only applications. Lugs shall be suitable for terminating the size and quantity of conductors as indicated.

- F. All terminal lugs shall be UL Labeled for AL or CU conductors rated for 75 degrees C.

2.04. MAIN PROTECTIVE DEVICE(S)

- A. The main protective device(s) shall employ fixed type mounting. The devices shall be individually mounted in the switchboard.
- B. Provide insulated case circuit breaker(s)
 - 1. Breaker(s) shall be 600V AC, 50/60 HZ rated. The frame and current ratings shall be as indicated on the Drawings.
 - 2. Circuit breaker trip functions shall include adjustments for continuous amperage, long time pickup and delay, instantaneous, and ground-fault pickup and delay. Fault indication shall be provided on the trip unit for overload, short time, short circuit, and ground fault conditions.
 - 3. Breaker(s) must carry a UL 429 Listing, be rated for 100% continuous duty, approved for reverse connection, and shall be stationary mounted, suitable for manual operation. Breaker(s) must carry an individual serial number with factory-maintained production and test records.
 - 4. The breaker operating mechanism shall be a true two-step stored energy mechanism that shall provide a five cycle maximum closing time. Separate indicators shall be provided to show charged/ discharged status of the mechanism and open/closed status of the breaker's contacts. The breaker mechanism shall enable to be discharged without closing the main contacts. The manual charging handle shall be interlocked with the manual close button to prevent simultaneous operation.
- C. Provide fused switch(es)
 - 1. Switch(es) shall be 600V AC, 50/60 HZ rated and shall be UL Listed for application at 100% of their continuous current rating. The current rating shall be as indicated on the Drawings.
 - 2. Switch(es) shall be bolted pressure contact, load interrupting, fast- acting stored energy type, fused devices. The contact interrupting capacity shall be 12 times the continuous current rating and 200,000 AIC for the combination of switch and fuse. The switch shall have electrical trip mechanism.
 - 3. Fast-acting current limiting fuses shall be installed in each ungrounded leg of the switch.
 - 4. Switch shall be equipped with "blown fuse" protection to automatically trip switch upon loss of any fuse.

5. Switch shall be equipped with factory installed ground fault sensing system and indication.
- D. Provide phase-loss protection
1. Phase loss protection system shall trip the main disconnect device(s) under single-phase condition or a voltage imbalance of 12% or more.
 2. The system shall not trip on total loss of voltage on all phases and shall have a built-in time delay with a range of 3 - 12 seconds. Capacitor trip component is required.
 3. The system shall be equipped with LED fault indicators installed on the front of switchboard enclosure.

2.05. DISTRIBUTION PROTECTIVE DEVICES

- A. Provide molded case circuit breakers
1. Circuit breakers shall be provided with trip rating, poles and minimum interrupting rating as indicated on the Drawings or specified herein.
 2. Circuit breakers 600 amps or less shall be of the quick-make, quick-break, trip-free thermal magnetic type.
 3. Circuit breakers greater than 600 amps shall be of the quick-make, quick-break, trip-free, solid state type. Solid state breaker trip functions shall include adjustments for continuous amperage, long time pickup and delay, instantaneous, and ground-fault pickup and delay.
 4. Circuit breakers shall be bolted to the switchboard bus.
 5. Provide shunt trip device to electrically trip circuit breakers where indicated on the Drawings.
 6. Lug sizes shall be provided to accommodate the specified feeder(s).

2.06. AUXILIARY EQUIPMENT

- A. Identification
1. Refer to Section 16000 - Electrical General for nameplate requirements.

B. Metering

1. Provide a multi-function, high accuracy digital power metering instrumentation module equipped with an LCD display. The module shall provide measurements for current, voltage and power parameters as follows:
 - a. Phase currents, phase voltages, average phase current, average phase voltage, amp demand, neutral current, kW, kW demand, kW hours, kVAR, kVAR hours, power factor, and frequency.

C. Provide surge protective devices (SPD) integral to the switchboard assembly complying with the following:

1. SPD shall be listed and component recognized in accordance with UL 1283 and UL 1449 Third Edition.
2. SPD shall be installed by and shipped from the electrical distribution equipment manufacturer's factory as an integral device to the electrical equipment.
3. SPD shall provide surge current diversion paths for all modes of protection; L-L, L-N, L-G, N-G in WYE systems (L-N or L-G if at service entrance with bonding jumper), and L-L, L-G in DELTA systems.
4. SPD shall be modular in design. Each module shall be fused with a surge rated fuse and incorporate a thermal cutout device.
5. A UL approved disconnect switch shall be provided as a means of disconnect in the switchboard device only.
6. SPD shall meet or exceed the following criteria:
 - a. Maximum surge current capability (single pulse rated) shall be 120 KA per mode.
 - b. Nominal discharge current rating shall be 20 KA.
 - c. MCOV shall not be less than 125% of the nominal system operating voltage.
 - d. The maximum ANSI/UL 1449 3rd Edition voltage protection rating for the device shall not exceed the following:

Modes	208Y/120	480Y/277
L-N; L-G; N-G	700	1200
L-L	1200	2000

7. SPD shall have successfully passed ANSI/IEEE C62.41-1991 10 x 1000 μ s waveform testing performed by a nationally recognized independent test lab.
8. SPD shall have a minimum EMI/RFI filtering of -50dB at 100 kHz with an insertion ratio of 50:1 using MIL-STD-220A methodology.
9. SPD shall be provided with 1 set of NO/NC dry contacts.
10. SPD shall have a warranty for a period of five years, incorporating unlimited replacements of suppressor parts if they are destroyed by transients during the warranty period. Warranty shall be the responsibility of the electrical distribution equipment manufacturer and shall be supported by their respective field service division.

PART 3 EXECUTION

3.01. INSTALLATION

- A. Install switchboard on 4" high concrete pad, the horizontal dimensions of which shall exceed the base dimensions of the switchboard by 3" on all sides.
- B. Lace and group conductors installed with nylon tie straps. Only one conductor shall be installed under each terminal. Form and train conductors in enclosure neatly parallel and at right angles to sides of box. Un-insulated conductor shall not extend beyond 1/8" from terminal lug.
- C. Do not splice conductors in switchboard. Where required, install junction box adjacent to enclosure and splice or tap conductors in box. Refer to number of conductors in a conduit limitation defined in the conductors and cables section of the Specifications and do not exceed.
- D. Maintain conductor phase color code requirement described in the conductors and cables section of the Specifications.
- E. Switchboard name/designation shall be labeled per the requirements of Section 16000 - Electrical General 2.02 A, as well as each individual feeder breaker/fused switch and branch circuit breaker/fused switch.

3.02. CLEANING AND ADJUSTMENT

- A. After completion, clean the interior and exterior of dirt, paint and construction debris.
- B. Circuit breaker adjustments shall be performed as directed by the Engineer at projection completion.

END OF SECTION 16200

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SECTION 16250

EMERGENCY STANDBY GENERATOR SYSTEM AND SWITCHING

PART 1 GENERAL

1.01. DESCRIPTION

- A. Provide an emergency standby power system for supply of power in the event of failure of normal supply, consisting of a liquid cooled engine, an AC alternator and system controls with all necessary accessories for a complete operating system, including but not limited to the items as specified hereinafter. System shall comply with NFPA 110 requirements, and the latest requirements of the U.S. Environmental Protection Agency (EPA).
- B. Generator shall be rated as shown on the drawings, at 30% maximum voltage dip.
- C. Provide automatic operation from automatic transfer switch(es) described within this specification so that the system comes on line fully automatically, and after restoration of utility automatically retransfers load to normal power, shuts down the generator and returns to readiness for another operating cycle.

1.02. CODES AND STANDARDS

- A. The emergency generator system shall conform to the requirements of the following:
 - 1. NFPA 110 – Emergency and Standby Power Systems
 - 2. NFPA 30 – Flammable and Combustible Liquids Code
 - 3. NFPA 37 – Standard for Installation and Use of Stationary Combustion Engines and Gas Turbines

1.03. MANUFACTURER QUALIFICATIONS

- A. This system is designed based upon products of Generac. Caterpillar/ Olympian, Cummins/Onan, **Kohler** and MTU/Detroit Diesel are considered to be approved equals provided they meet every portion of this written specification. The manufacturer must be regularly engaged in the production of engine-alternator sets and associated controls for a minimum of ten years, so there is one source of supply and responsibility. The complete engine generator set system shall be supplied by the manufacturer's authorized distributor only.

PART 2 PRODUCTS

2.01. ENGINE

- A. The prime mover shall be a liquid cooled, gaseous fueled turbo- charged/after cooled engine of 4-cycle design. The engine shall be a single piece, cast block. Multiple blocks combined are not acceptable. The engine will utilize in-cylinder combustion technology, as required, to meet the applicable EPA NSPS rule for stationary reciprocating compression ignition engines. Additionally, the engine shall comply with the State Emission regulations at the time of installation/ commissioning. Actual engine emissions values must be in compliance with applicable EPA emissions standards per ISO 8178-D2 Emissions Cycle at specified kW/bHP rating. Utilization of the "Transition Program for Equipment Manufacturers" (also known as "Flex Credits") to achieve EPA certification is not acceptable. The in-cylinder engine technology must not permit unfiltered exhaust gas to be introduced into the combustion cylinder.
- B. The engine is to be cooled with a unit-mounted radiator, fan, water pump, and closed coolant recovery system providing visual diagnostic means to determine if the system is operating with a normal engine coolant level. The radiator shall be designed for operation in 104 degrees Fahrenheit (40 degrees Celsius) ambient temperature.
- C. The intake air filter with replaceable element must be mounted on the unit. Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have a replaceable oil filter with internal bypass and replaceable elements. Engine coolant and oil drain extension must be provided to outside the mounting base for cleaner and more convenient engine servicing. A fan guard must be installed for personnel safety.
- D. The engine shall have a battery charging DC alternator with a transistorized voltage regulator. Remote 2-wire starting shall be by a solenoid shift, electric starter.
- E. Engine speed shall be governed by an electronic governor to maintain alternator frequency within 0.5% from no load to full load alternator output. Steady state regulation is to be + or - 0.25%.
- F. The engine fuel system shall be designed for operation on natural gas having a BTU content of 1000 BTU per cubic foot. A carburetor, secondary regulator, fuel lock-off solenoid and all piping must be installed at the point of manufacturing, terminating at a single pipe opening external to the mounting base. Pressure required is 7 - 16 inches water column, or .35-.50 psi when generator is operating at 100% load. For gensets above 150 kW, pressure required is 1.5 psi minimum, 5 psi maximum.

- G. Sensing elements to be located on the engine for low oil pressure shutdown, high coolant temperature (low coolant level shutdown), overspeed shutdown, overcrank shutdown. These sensors are to be connected to the control panel using a wiring harness with the following features: wire number labeling on each end of the wire run for easy identification, a molded rubber boot to cover the electrical connection on each sensor to prevent corrosion and all wiring to be run in flexible conduit for protection from the environment and any moving objects.
- H. The engine shall have an engine-mounted, thermostatically-controlled jacket water heater to aid in quick starting. It will be of adequate wattage as recommended by the engine manufacturer. The Contractor shall provide proper branch circuit from normal utility power source.

2.02. ALTERNATOR

- A. The alternator shall be a 4-pole revolving field type, for 3-phase, 60 Hz (voltage indicated on Drawings) with a brushless exciter. The stator shall be directly connected to the engine flywheel to ensure permanent alignment. The generator shall meet temperature rise standards for UL 1446 Class H or better varnish. All leads must be extended into the AC connection panel. The alternator shall be protected by an automatic reset field circuit breaker, or over excitation sensing voltage regulator.
- B. Load acceptance shall be 100% of nameplate kW rating and meet the requirements of NFPA 110. The engine-generator set shall be so designed that instantaneous voltage dip upon application of nameplate kW/kVA shall not exceed 30% with recovery to stable operation within 10 seconds. Sustained voltage dip data is not acceptable.
- C. A solid state voltage regulator designed and built by the engine-generator set manufacturer must be used to control output voltage by varying the exciter magnetic field to provide + or - 1% regulation during stable load conditions. Should an extremely heavy load drop the output frequency, the regulator shall have a voltage drop of 4 volts/hertz to maximize motor starting capability. The frequency at which this drop operation begins must be adjustable, allowing the generator set to be properly matched to the load characteristics ensuring optimum system performance.
- D. The voltage regulator must contain a limiting circuit to prevent output voltage surges in excess of 110% of rated voltage during generator set operation. On a loss of the sensing signal, the voltage regulator must shutdown to prevent an overvoltage condition from occurring. A voltage regulator that can go into a full field condition is unacceptable. A rheostat shall provide a minimum of + or - 10% voltage adjustment from the rated value.

- E. A NEMA 1 panel that is an integral part of the generator set must be provided to allow the installer a convenient location in which to make electrical output connections. An isolated neutral lug must be included by the generator set manufacturer to ensure proper sizing.
- F. The electric plant shall be mounted with vibration isolators on a welded steel base which shall permit suitable mounting to any level surface.
- G. Terminal lugs shall be factory-installed for load-side feeder connections.

2.03. CONTROLS

- A. All engine alternator controls and instrumentation shall be designed, built, wired, tested and shock mounted in a NEMA 1 enclosure to the engine-generator set by the manufacturer. It shall contain panel lighting and a fused DC circuit to protect the controls. It shall provide true RMS sensing to ensure AC metering accuracy to within +/- 1% of rated AC voltage (L-L and L-N) and current.
- B. The engine-generator set shall contain a complete engine start-stop control which starts the engine on closing contacts and stops the engine on opening contacts. A cyclic cranking limiter shall be provided to open the starting circuit after five attempts if the engine has not started within that time. Engine control modules must be solid state plug-in type for high reliability and easy service. The engine controls shall also include a 3- position selector switch with the following positions: RUN/AUTO/STOP. A red annunciator lamp shall be energized when the switch is not in auto.
- C. Safety shutdown monitoring system shall include solid state engine monitor with individual lights and one common external alarm contact indicating the following conditions: Overcrank shutdown, Overspeed shutdown, High Coolant Temperature (Low Coolant Level shutdown), Low Oil Pressure shutdown. Monitoring system shall include lamp test switch or engine control switch for manual reset of tripped conditions. Engine RPM is to be monitored by an independent permanent magnet sensor. If there is a failure in this circuit, the engine must shut down immediately and illuminate an overspeed condition.
- D. Engine control panel instrumentation shall consist of an oil pressure gauge, coolant temperature gauge, DC ammeter and an engine run hour meter located on the unit control panel. Alternator instrumentation must include analog or digital meters to indicate output voltage, amperage, kW, kVA, PF and frequency.

E. Provide the following items installed at the factory:

1. Pre-alarms for low coolant temperature, high water temperature and low oil pressure must be provided to anticipate possible problems before the system becomes inoperative. Yellow lights labeled on the control panel will illuminate should the associated parameter be exceeded.
2. Engine battery voltage is to be monitored to detect abnormal voltage levels. A light labeled on the control panel will illuminate should a low voltage condition be experienced.
3. One alarm horn to actuate upon engine fault shutdown.
4. Emergency stop button to immediately shut down the engine upon actuation.

2.04. MISCELLANEOUS EQUIPMENT

A. The following equipment is to be installed at the engine- generator set manufacturer's facility:

1. Exhaust silencer(s) shall be provided of the size as recommended by the manufacturer and shall be critical grade. The silencer(s) shall have a flexible, seamless, stainless steel exhaust connection and rain cap. All components must be properly sized to assure operation without excessive back pressure when installed.
2. Provide an automatic dual rate battery charger manufactured by the engine-generator set supplier. The automatic equalizer system shall monitor and limit the charge current to 10 amps. The automatic battery charger shall be rated no less than 10 amps. The charger must have a maximum open circuit voltage of 35 volts and be protected against a reverse polarity connection. The battery charger is to be factory installed on the generator set. Due to line voltage drop concerns, a battery charger mounted in the transfer switch will be unacceptable. Unit to operate on 120V.
3. A heavy duty, lead acid battery set shall be provided by the generator set manufacturer of adequate voltage and amperage capacity to start and operate the engine. Provide all intercell and connecting battery cables as required.
4. Weather Protective Enclosure: The engine-generator set shall be factory enclosed in a heavy gauge steel enclosure constructed with corner posts and powder coated baked finish. The enclosure is to have large, easily opened doors to allow access to the engine, alternator and control panel. Each door is to be fitted with stainless steel, lockable hardware with identical keys. Padlocks do not meet this specification.

- B. The following equipment is to be provided by the engine- generator set manufacturer and shipped loose with the unit:
1. Provide a remote annunciator panel for wall mounting. The panel shall have an ALARM switch that when activated silences the audible alarm. A TEST switch must be included to verify the lights are functional. The following alarms shall be included for the remote annunciator:
 - a. Overcrank
 - b. Low Coolant/Water Temperature
 - c. High Coolant/Water Temperature Pre-Alarm
 - d. High Coolant/Water Temperature Shutdown
 - e. Low Oil Pressure Pre-Alarm
 - f. Low Oil Pressure Shutdown
 - g. Overspeed
 - h. Low Fuel Alarm
 - i. Control Switch Not In Auto
 - j. Provide a minimum of four (4) spare lights for other potential alarms.
 2. Provide a manual breakglass station located on the weatherproof enclosure for shutdown of the generator. Station shall be appropriately labeled.

PART 3 AUTOMATIC TRANSFER SWITCH

3.01. SCOPE

- A. Furnish and install the 4-pole automatic transfer switch(es) with amperage, voltage, and withstand rating as shown on the plans. Each automatic transfer shall consist of a double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation. All transfer switches and controllers shall be the products of the same manufacturer.

3.02. CODES AND STANDARDS

- A. The automatic transfer switch(es) and controls shall conform to the requirements of:
1. UL 1008 – Standard for Transfer Switch Equipment
 2. IEC 947-6-1 Low-voltage Switchgear and Control gear; Multifunction equipment; Automatic Transfer Switching Equipment

3. NFPA 70 – National Electrical Code
4. NFPA 110 – Emergency and Standby Power Systems
5. IEEE Standard 446 – IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
6. NEMA Standard ICS10-1993 (formerly ICS2-447) – AC Automatic Transfer Switches
7. UL 508 Industrial Control Equipment

3.03. ACCEPTABLE MANUFACTURERS

- A. Automatic transfer switch(es) shall be based on ASCO 7000 Series. Other acceptable manufacturers shall be Russell.

3.04. MECHANICALLY HELD TRANSFER SWITCH

- A. The transfer switch shall be electrically operated and mechanically held. The electrical operator shall be a momentarily energized, single-solenoid mechanism. Main operators which include overcurrent disconnect devices, linear motors or gears shall not be acceptable. The switch shall be mechanically interlocked to ensure only two possible positions, normal or emergency.
- B. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. Switches rated 600 amps and higher shall have front removable and replaceable contacts. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.
- C. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof, which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.
- D. The ATS shall be provided with fully rated overlapping neutral transfer contacts. The neutrals of the normal and emergency power sources shall be connected together only during the transfer and retransfer operation and remain connected together until power source contacts close on the source to which the transfer is being made. The overlapping neutral contacts shall not overlap for a period greater than 100 milliseconds. Neutral switching contacts which do not overlap are not acceptable.

3.05. MICROPROCESSOR CONTROLLER

- A. The controller's sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the ability to communicate serially through an optional serial communication module.

- B. All customer connections shall be wired to a common terminal block to simplify field-wiring connections.
- C. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:
 - 1. IEEE472 (ANSI C37.90A) Ring Wave Test
 - 2. EN55011 1991 Class A Conducted and Radiated Emission
 - 3. EN61000-4-2 Electrostatic Discharge Immunity, Direct Contact & Air Discharge
 - 4. EN61000-4-3 Radiated Electromagnetic Field Immunity
 - 5. EN61000-4-4 Electrical Fast Transient Immunity
 - 6. EN61000-4-5 Surge Immunity
 - 7. ENV50141 HF Conducted Disturbances Immunity

3.06. ENCLOSURE

- A. The ATS shall be furnished in a NEMA type 1 enclosure unless otherwise shown on the plans.

3.07. STANDARD FEATURES

- A. A three position momentary-type test switch shall be provided for the test/automatic/reset modes. The test position will simulate a normal source failure. The reset position shall bypass the time delays on either transfer to emergency or retransfer to normal.
- B. A set of DPDT gold-flashed contacts rated 10 amps, 32 VDC shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.
- C. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact closed, when the ATS is connected to the emergency source.
- D. LED indicating lights (16 mm industrial grade, type 12) shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).
- E. LED indicating lights (16 mm industrial grade, type 12) shall be provided and energized by controller outputs. The lights shall provide true source

availability of the normal and emergency sources, as determined by the voltage sensing trip and reset settings for each source.

- F. An inphase monitor shall be provided in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The inphase monitor shall be specifically designed for and be the product of the ATS manufacturer. The inphase monitor shall be equal to ASCO Feature 27.
- G. Engine Exerciser: The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to seven different exercise routines. For each routine, the user shall be able to:
 - 1. Enable or disable the routine.
 - 2. Enable or disable transfer of the load during routine.
 - 3. Set the start time,
 - time of day
 - day of week
 - week of month (1st, 2nd, 3rd, 4th, alternate or every).
 - 4. Set the duration of the run.

At the end of the specified duration the switch shall transfer the load back to normal and run the generator for the specified cool down period. A 10-year life battery that supplies power to the real time clock in the event of a power loss will maintain all time and date information.

- H. System Status: The controller LCD display shall include a "System Status" screen which shall be readily accessible from any point in the menu by depressing the "ESC" key a maximum of two (2) times. This screen shall display a clear description of the active operating sequence and switch position. For example,
 - Normal Failed
 - Load on Normal
 - TD Normal to Emerg
 - 2min15s

Controllers that require multiple screens to determine system status or display "coded" system status messages, which must be explained by references in the operator's manual, are not permissible.

- I. Data Logging: The controller shall have the ability to log data and to maintain the last 99 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non- volatile memory:
 1. Event Logging
 - a. Data and time and reason for transfer normal to emergency
 - b. Data and time and reason for transfer emergency to normal
 - c. Data and time and reason for engine start
 - d. Data and time engine stopped
 - e. Data and time emergency source available
 - f. Data and time emergency source not available
 2. Statistical Data
 - a. Total number of transfers
 - b. Total number of transfers due to source failure
 - c. Total number of days controller is energized
 - d. Total number of hours both normal and emergency sources are available

3.08. ACCESSORIES

- A. Provide two double throw contacts that operate when emergency source voltage is present at the switch terminals, ASCO accessory 18B.
- B. Provide two double throw contacts that operate when normal source voltage is present at the switch terminals, ASCO accessory 18G.
- C. Provide a selective load disconnect circuit (Elevator Contacts) that operates with an adjustable time delay from 1 second to 5 minutes before transfer of the ATS to emergency and resets 1 second to 5 minutes after the retransfer to normal, ASCO accessory 31Z.

3.09. CONTROLLER DISPLAY AND KEYPAD

- A. A 4-line, 20-character LCD display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the serial communications input port. The following parameters shall only be adjustable via DIP switches on the controller:
 1. Nominal line voltage and frequency

2. Single or three phase sensing
3. Operating parameter protection
4. Transfer operating mode configuration
(Open transition, Closed transition, or Delayed transition)

All instructions and controller settings shall be easily accessible, readable and accomplished without the use of codes, calculations, or instruction manuals.

3.10. VOLTAGE, FREQUENCY AND PHASE ROTATION SENSING

- A. Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

Parameter	Sources	Dropout/Trip	Pickup/Reset
Undervoltage	N&E, 3Ø	70 to 98%	85 to 100%
Overvoltage	N&E, 3Ø	102 to 115%	2% below trip
Underfrequency	N&E	85 to 98%	90 to 100%
Overfrequency	N&E	102 to 110%	2% below trip
Voltage unbalance	N&E	5 to 20%	1% below drop-out

- B. Repetitive accuracy of all settings shall be within 0.5% over an operating temperature range of -20 degrees C to 60 degrees C.
- C. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via serial communications port access.
- D. The controller shall be capable (when activated by the keypad or through the serial port) of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or CBA).
- E. Source status screens shall be provided for both normal and emergency to provide digital readout of voltage on all 3 phases, frequency, and phase rotation.

3.11. TIME DELAYS

- A. An adjustable time delay of 0 to 6 seconds shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Capability shall be provided to extend this time delay to 60 minutes by providing an external 24 VDC power supply.
- B. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.

- C. Two time delay modes (which are independently adjustable) shall be provided on retransfer to normal. One time delay shall be for actual normal power failures and the other for the test mode function. The time delays shall be adjustable from 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.
- D. A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.
- E. A time delay activated output signal shall also be provided to drive an external relay(s) for selective load disconnect control.

The controller shall have the ability to activate an adjustable 0 to 5 minute time delay in any of the following modes:

- 1. Prior to transfer only
 - 2. Prior to and after transfer
 - 3. Normal to emergency only
 - 4. Emergency to normal only
 - 5. Normal to emergency and emergency to normal
 - 6. All transfer conditions or only when both sources are available
- F. The controller shall also include the following built-in time delays for optional Closed Transition and Delayed Transition operation:
 - 1. 1 to 5 minute time delay on failure to synchronize normal and emergency sources prior to closed transition transfer.
 - 2. 0.1 to 9.99 second time delay on an extended parallel condition of both power sources during closed transition operation.
 - 3. 0 to 5 minute time delay for the load disconnect position for delayed transition operation.
 - G. All time delays shall be adjustable in 1 second increments, except the extended parallel time, which shall be adjustable in .01 second increments.
 - H. All time delays shall be adjustable by using the LCD display and keypad or with a remote device connected to the serial communications port.

3.12. WITHSTAND AND CLOSING RATINGS

- A. The ATS shall be rated to close on and withstand the available RMS symmetrical short circuit current at the ATS terminals with the type of overcurrent protection shown on the plans.

- B. The ATS shall be UL Listed in accordance with UL 1008 and be labeled in accordance with that standard's 1.5 and 3-cycle long-time ratings. ATSs which are not tested and labeled with 1.5 and 3-cycle (any breaker) ratings and have series or specific breaker ratings only are not acceptable.

3.13. SERVICE REPRESENTATION

- A. The ATS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.
- B. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.
- C. The automatic transfer switch(es) shall be supplied by the generator set distributor in order to establish and maintain a single source of system responsibility and coordination.

PART 4 MISCELLANEOUS

4.01. FACTORY TESTING

- A. Before shipment of the equipment, the engine-generator set shall be tested under rated 0.8 PF load for performance and proper functioning of control and interfacing circuits. A factory test report shall be made available upon request. Tests shall include:
 - 1. Verifying all safety shutdowns are functioning properly.
 - 2. Both no-load and full-load steady state voltage checks shall be tested and measured line to line and speed (frequency) checks. Line-to-line current at rated voltage shall also be tested and measured.

4.02. OWNER'S MANUALS

- A. **Three (3) sets** of Owner's manuals specific to the product supplied must accompany delivery of the equipment. General operating instruction, preventive maintenance, wiring diagrams, schematics and parts exploded views specific to this model must be included. Provide an electronic copy of Owner's Manual to the Owner.

4.03. INSTALLATION

- A. The Contractor shall install the complete electrical generating system including all fuel connections in accordance with the manufacturer's recommendations as reviewed by the Engineer.

- B. The Contractor shall furnish to the Owner a manufacturer tank chart with inches-to-gallon conversions. The Contractor shall mount a laminated copy of the chart inside the generator module for use by the delivery operator.

4.04. SERVICE

- A. Supplier of the electric plant and associated items shall have permanent service and parts facilities in this trade area. These facilities shall comprise a permanent force of factory trained service personnel on 24-hour call, experienced in servicing this type of equipment, providing warranty and routine maintenance service to afford the Owner maximum protection. Delegation of this service responsibility for any of the equipment listed herein will not be considered fulfillment of these specifications. Service contracts shall also be available.

4.05. WARRANTY

- A. The standby electric generating system components, complete engine-generator set and automatic transfer switch shall be warranted by the manufacturer against defective materials and factory workmanship for a period of five years. Such defective parts shall be repaired or replaced at the manufacturer's option. In addition, all labor for the replacement of these parts for the engine-generator set and transfer switch will be covered for the first two years. The warranty period shall commence when the standby power system is first placed into service. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable and must be covered by the engine manufacturer. Satisfactory warranty documents must be provided. Also, in the judgment of the specifying authority, the manufacturer supplying the warranty for the complete system must have the necessary financial strength and technical expertise with all components supplied to provide adequate parts, service and warranty support.

4.06. CHECKOUT & STARTUP

- A. The supplier of the electric generating plant and associated items covered herein shall provide factory trained technicians to check out the completed installation and to perform an initial startup inspection to include:
 - 1. Ensuring the engine starts (both hot and cold) within the specified time.
 - 2. Verification of engine parameters within specification.
 - 3. Set no load frequency and voltage.
 - 4. Test all automatic shutdowns of the engine-generator.

5. Perform a full load test of the electric plant, ensuring full load frequency and voltage are within specification by using building load supplemented with load banks. Test shall be per NFPA 110- 2002 Paragraph 5-13.2.5.

4.07. SUBMITTALS

- A. Provide complete sets of Engineering Submittals for approval prior to production release, showing all components, in addition to the engine, generator and automatic transfer switch. Submittals shall include complete system interconnection wiring diagrams and manufacturer's warranty form indicating compliance with these specifications.

4.08. SUBSTITUTIONS

- A. The emergency power system has been designed to the specified manufacturer's electrical and physical characteristics, including the equipment sizing, spacing, mounts, electrical wiring, ventilation equipment, fuel and exhaust components. Should any substitutions be made, the Contractor shall bear responsibility for the installation, coordination and operation of the system as well as any engineering and redesign costs which may result from such substitutions. Alternate equipment suppliers shall furnish equipment submittals 14 days prior to bid date for approval to bid. As part of the submittals, the substitute manufacturer shall supply as a minimum engine, alternator, control panel and automatic transfer switch wiring diagrams and schematics. A separate list of all printed circuit boards with part numbers and current pricing must also be included.

4.09. TRAINING

- A. Manufacturer shall provide eight (8) hours of on-site training for the Owner's operations staff. Entire training session shall be video recorded and a DVD copy of the training session provided to the Owner.

END OF SECTION 16250

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SECTION 16300
MOTOR CONTROL CENTERS

PART 1 GENERAL

1.01. DESCRIPTION

- A. The work required under this section of the Specifications consists of the installation of all motor control centers for use on systems 600 volts and below. All materials and devices which are an integral part of the motor control centers shall be provided under this section of the Specifications.
- B. Motor control centers as specified in these Contract Documents are free standing, dead-front, metal enclosed panels of one or more sections.

1.02. QUALITY ASSURANCE

- A. Acceptable Manufacturers: Products of the following manufacturers, which comply with these Specifications, are acceptable:
 - 1. General Electric
 - 2. Square D
 - 3. Siemens
 - 4. Cutler Hammer
- B. Equipment Dimensions
 - 1. Dimensions indicated on the drawings are the maximum allowable and shall not be exceeded. Where switchboards(s) of acceptable manufacturers listed exceed the maximum dimensions, products of such manufacturers shall not be acceptable.
- C. Coordination
 - 1. Coordinate installation with architectural and structural features, equipment installed under other sections of the Specifications and electrical equipment to ensure access and so that clearance minimums are provided.
- D. Standards

The motor control centers and protection devices in this specification are designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. ANSI/NEMA 250 - ANSI/NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum)
2. ANSI/NFPA 70, National Electrical Code
3. CSA C22.2 No. 0 - M91, General Requirements of Canadian Electrical Code, Part II
4. CSA C22.2 No. 14 - 95, Industrial Control Equipment
5. MIL SPEC TT-C-490, Rev. D, Cleaning Methods for Ferrous Surfaces and Pretreatment for Organic Coatings
6. NEMA ICS 1 -, Industrial Control and Systems: General Requirements
7. NEMA ICS 2 -, Industrial Control and Systems: Controllers, Contactors and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC
8. NEMA ICS 3 -, Industrial Control and Systems; Factory Built Assemblies
9. NEMA ICS 6 -, Industrial Control and Systems: Enclosures
10. NEMA ST 20 -, Dry Type Transformers for General Applications
11. UL 508 -, Industrial Control Equipment (only for devices included in specification)
12. UL 845 -, Motor Control Centers

1.03. SUBMITTALS

- A. Refer to Section 16000 - Electrical General for submittal requirements.
- B. Shop Drawings: Submit shop drawings to indicate compliance with the Contract Documents.
 1. Include electrical characteristics and ratings for each motor control center with dimensions, mounting, bus material, voltage, bracing, ampere rating, mains, poles and wire connection, and any accessories.
 2. Include bussing diagram indicating each starter position.
 3. Provide a schedule indicating overcurrent device, trip and size, poles, frame type, fuse size and type, or circuit breaker interrupting capacity.

1.04. DELIVERY, STORAGE, AND HANDLING

- A. The manufacturer shall separate motor control center into shipping splits. Each shipping split shall include a removable lifting angle, or lifting tabs, for positioning equipment at job site.

- B. The Contractor shall store, protect, and handle motor control centers in accordance with recommended practices listed in the manufacturer's installation and maintenance manuals.
- C. The manufacturer shall deliver each motor control center split on individual shipping skids wrapped for protection.
- D. The Contractor shall inspect and report concealed damage to carrier within specified time.
- E. The Contractor shall store in a clean, dry space. Maintain factory protection or cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. (Heat enclosures to prevent condensation.)
- F. The Contractor shall handle in accordance with NEMA ICS - 2.3 - 1989 and manufacturer's written instructions to avoid damaging equipment, installed devices, and finish. Lift only by installed lifting eyes.

1.05. WARRANTY

- A. Manufacturer warrants equipment to be free from defects in materials and workmanship for one (1) year from date of certificate of occupation or 18 months from date of purchase, whichever occurs first.

1.06. FIELD MEASUREMENTS

- A. The Contractor shall make all necessary field measurements to verify that equipment shall fit in allocated space in full compliance with minimum required clearances specified in National Electrical Code.

PART 2 PRODUCTS

2.01. GENERAL

- A. Vertical sections and individual units shall be UL Labeled where possible.
- B. Wiring shall be NEMA Class I, Type B-D. Combination starter units shall be wired out to pull-apart terminal blocks for easy removal without disturbing either factory or field-installed wiring.
- C. Motor control center splits shall be assembled and packaged to withstand all shipping stresses.

2.02. COMPONENTS

- A. Refer to Drawings for: actual layout and location of equipment and components; current ratings of devices, bus bars, and components; voltage ratings of devices, components and assemblies; and other required details.

B. Structure

1. Motor control center shall be rated as indicated in drawings.
2. Structures shall be totally enclosed, dead-front, free standing assemblies.
3. Enclosures shall be NEMA Type 1, gasketed.
4. Motor control center shall consist of the required number of vertical section(s) of heavy gauge steel bolted together forming a rigid unit assembly. Removable lifting angles or tabs shall be mounted on top of motor control center sections. Removable bottom channel sills shall be mounted front and rear of vertical section and shall extend full width of lineup. Motor control center sections shall be nominally 90 inches high and in multiples of 20 inch widths, with larger widths as required for oversized starters and relay panels. Depth shall be 20 inches.
5. All section parts shall be accessible from front for maintenance and rearrangement.
6. Each 20 inch section shall have all necessary hardware and bussing for modular plug-in units to be added at any point in section. Unused space shall be covered by hinged blank doors and equipped to accept future units.
7. Each section shall have a top plate and a bottom plate. Each plate shall be removable to cut conduit entry openings.
8. Each device compartment shall have an individual flange formed pan type door with quick release, quarter turn latches.

C. Horizontal Pullbox

1. Vertical sections shall contain 12 inch high horizontal wireway at top of all sections for incoming lines and wiring between sections. A 6 inch high horizontal wireway shall be located at bottom of all sections.

D. Vertical Wiring Trough

1. A separate removable vertical wire trough door shall be furnished adjacent to each plug-in device. Wire trough permits field control wiring to be isolated in trough area rather than drawn through cutouts into device.
2. Cable tie supports shall be furnished in vertical wire trough to hold cable and wiring in place. Each individual device compartment shall have a side barrier to permit pulling wire from wire trough areas without disturbing adjacent device compartments.

E. Incoming Power/Main Protective Devices

1. The MCC shall be connected to the supply source by cable.
2. The Main device shall be main lugs. The amp rating of this device shall be as specified on drawings.

F. Bus Systems

1. Main Horizontal Bus

- a. Power shall be distributed by means of a continuous horizontal bus (size as indicated on drawings).
- b. Main bus shall be copper, tin-plated and enclosed in isolated compartment at top of each vertical section.
- c. Bus bars shall be edgewise mounted, one above the other, and supported on reinforced insulators.
- d. Main bus shall be isolated from wire troughs, starters, and other areas by insulated barriers. All bus and splice bar connections shall be accessible by sliding open the barrier panels or removing stationary barriers.
- e. Main bus splicing between shipping splits shall be accomplished from the front without any structural disassembly. Bus ratings 1200 amperes and larger may require removal of barriers to gain access to main bus connections.
- f. Bus bars shall be fully rated as indicated in drawings. Bus bars shall be arranged for future extension.

2. Vertical Bus

- a. Vertical bus shall be rated as indicated in drawings. Bus shall be tin-plated copper, size as indicated in drawings.
- b. The vertical bus shall be housed in a molded glass-filled polyester support that provides bus insulation and braces the bus against the forces generated during a short circuit. These supports shall have openings for unit stab connections. Each opening shall be provided with a manual shutter to close off the stab openings. These shutters shall be attached to the structure so that when they are removed (to allow a stab connection) they are retained in the structure and are readily accessible for use should a plug-on unit be removed from the MCC.
- c. Vertical bus shall be connected directly to horizontal bus without using risers or other connectors.

- d. Units with circuit breaker disconnects through 250A frame shall connect to the vertical bus through a spring reinforced stab connector. Units with larger disconnects shall be connected directly to the main horizontal bus with appropriately sized cable or riser bus.
 - e. Bus bars shall be fully rated as indicated in drawings.
 - 3. Power busses shall be braced to withstand short circuit currents 65 KAIC as indicated on drawings.
 - 4. Ground bus shall be copper and extend full width at bottom of motor control lineup. Ground bus will be drilled and lugs shall be furnished as specified in drawings. Ground bus shall be sized per drawings.
 - 5. Neutral bus (where applicable) shall be half rated. Neutral bus shall be continuous throughout the control center. Lugs shall be of appropriate capacity. Bottom plates shall be furnished when neutral bus specified.
 - 6. Each vertical section shall have a tin-plated copper vertical ground bus that is connected to the horizontal ground bus. This vertical ground bus shall be installed so that the plug-on units engage the ground bus before engagement of the power stabs and shall disengage only after the power stabs are disconnected upon removal of the plug-on unit.
- G. Feeder Units
- 1. Feeder units shall be circuit breaker type.
 - 2. Feeder breakers shall be conventional thermal magnetic or solid state molded case (or equal).
- H. Combination Motor Starters Devices
- 1. Combination motor controllers shall have molded case circuit breaker disconnects.
 - 2. Circuit breaker disconnects for combination motor starters shall be thermal magnetic.
 - 3. Combination starters shall be rated as indicated on drawings.
 - 4. Combination starter types shall be full voltage non-reversing, or as shown on the drawings.
 - 5. Combination starters and feeder units shall use a positive guidance mechanical installation system to ensure positive stabbing of unit stab assembly to the vertical bus bars, where applicable.
 - 6. Unit operating handle shall be vertical lift, close coupled to unit disconnect for positive indication of disconnect position with unit door open or closed.

Handle shall be mechanically interlocked with door closed so that interlock must be defeated to open door with device energized, or to energize device with door open. Handle shall be able to be padlocked in OFF position with up to 3 padlocks with door opened or closed. Handle shall have drilling pattern to add padlock in ON position. Circuit breaker handles shall indicate TRIPPED position in addition to ON, OFF and RESET.

7. Unit shall be able to be padlocked in LOCKOUT position for maintenance.
8. When in LOCKOUT position, power stabs shall be disengaged from vertical bus bars so no power can enter unit.
9. Combination starters shall have drawout pull-apart control terminal blocks mounted on right-hand side. Control terminal boards are to be manually separable type. Combination starter units Sizes 1 to 4 up to 48 inches high shall be removable from section without removing control leads from terminal blocks.
10. Combination motor controller units shall have the following:
 - a. Individual control power transformers with one secondary lead furnished with a control fuse and the other secondary lead grounded. Control power transformer primary fuses are required.
11. Combination starter units shall have auxiliary devices as follows:
 - a. One NO and one NC auxiliary starter interlocks.
 - b. Door-mounted pilot devices: one red and one green indicating lamp and one H-O-A switch.

2.03. ACCESSORIES

- A. Furnish nameplates for each unit as required by Section 16000 - Electrical General.

2.04. TESTING

- A. Electrical tests before shipment shall include:
 1. Power circuit phasing
 2. Control circuit wiring
 3. Instrument transformers
 4. Meters
 5. Device electrical operation
 6. AC Dielectric tests (per NEMA ICS 1-109.21) of power and control circuits

2.05. FINISH

- A. All metal structural and unit parts shall be completely painted using an Electrode position process so that interior and exterior surfaces have a complete finish coat on and between them. The basic process shall consist of using an iron phosphate pretreatment for the improvement of paint adhesion and non-chrome sealer rinse to enhance corrosion resistance. The paint process shall consist of cleaning, rinses, phosphating, non-chromate sealer rinses, pre-paint rinses, painting, post painting rinse, a bake cure, and a cool down. Paint shall be UL recognized manufacturer's standard gray. All painted parts should be able to pass at least 300 hours of salt spray per ASTM b117 with less than 1/8 inch loss of paint from a scribed line.

PART 3 EXECUTION

3.01. INSTALLATION

- A. Install motor control center on 3" high concrete pad, the horizontal dimensions of which shall exceed the base dimensions of the enclosure by 3" on all sides.
- B. Lace and group conductors installed with nylon tie straps. Only one conductor shall be installed under each terminal. Form and train conductors in enclosure neatly parallel and at right angles to sides of box. Uninsulated conductor shall not extend beyond one-eighth of an inch from terminal lug.
- C. Do not splice conductors in motor control center. Where required, install junction box adjacent to enclosure and splice or tap conductors in box. Refer to number of conductors in a conduit limitation defined in the conductors and cables section of the Specifications and do not exceed.
- D. Maintain conductor phase color code requirement described in the conductors and cables section of the Specifications.

3.02. FIELD QUALITY CONTROL

- A. Inspect installed motor control center(s) for anchoring, alignment, grounding and physical damage.
- B. Megger and record phase to phase and phase to ground insulation resistance of each bus section. Megger for 1 minute for each measurement at minimum voltage of 500 VDC. Measured Insulation resistance shall be at least 1 megohm(s). Refer to manufacturer's instructions for proper testing procedures.
- C. Check tightness of all accessible mechanical and electrical connections with calibrated torque wrench. Minimum acceptable values are specified in manufacturer's instructions.

3.03. ADJUSTING

- A. Adjust all circuit breakers, switches, access doors, operating handles for free mechanical and/or electrical operation as described in manufacturer's instructions.
- B. Adjust circuit breaker trip and time delay settings to values specified by Electrical Engineer.

3.04. CLEANING

- A. Clean interiors of motor control centers to remove construction debris, dirt, shipping materials.
- B. Repaint scratched or marred exterior surfaces to match original finish.

END OF SECTION 16300

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SECTION 16450

GROUNDING

PART 1 GENERAL

1.01. DESCRIPTION

- A. The work required under this section of the Specifications consists of furnishing, installation and connections of the building grounding system. Exterior branch circuit wiring and feeder conductors extended beyond the building are included. The building electrical system shall be 3-phase, 4- wire grounded wye system supplemented with equipment grounding system. Equipment grounding system shall be established with equipment grounding conductors; the use of metallic raceways for equipment grounding is not acceptable.

1.02. REGULATORY REQUIREMENTS

- A. Install a complete grounding system in accordance with the National Electrical Code.

PART 2 PRODUCTS

2.01. GENERAL REQUIREMENTS

- A. Provide all materials under this section of the specifications.
- B. All materials shall be new, UL Listed, and bear a UL Label.
- C. Refer to Section 16120 - Conductors for conductor specification.

2.02. GROUNDING CONDUCTORS

- A. Grounding electrode conductor shall be bare or green insulated copper conductor sized as indicated on the Drawings.
- B. Equipment grounding conductors shall be green insulated conductors sized as indicated on the Drawings. Where size is not indicated on the Drawings, conductor size shall be determined from the National Electrical Code table on sizes of equipment grounding conductors.
- C. Bonding jumpers shall be flexible copper bonding jumpers sized in accordance with the National Electrical Code tables for grounding electrode conductors.

2.03. PANELBOARDS, TRANSFORMERS, AND DISCONNECT SWITCHES

- A. Provide each low voltage distribution and branch circuit panelboard with a copper equipment grounding bar brazed or riveted to the associated enclosures or cabinet and an insulated neutral bar.
- B. Provide a conductor termination grounding lug bonded to the enclosure of each equipment item.

2.04. DEVICES

- A. Each receptacle and switch device shall be furnished with a grounding screw connected to the metallic device frame.

2.05. GROUND RODS

- A. Ground rods shall be 3/4" x 10'-0" copper clad steel.

2.06. GROUNDING LUGS FOR LOW VOLTAGE SYSTEMS

- A. Grounding Lugs and Hardware
 - 1. Grounding lugs shall be 2-hole and installed with a crimper that when properly executed the die of the crimper impresses the die # on the lug base. All lugs shall be sleeved with clear heat-shrink to allow for inspection of the crimp. Silicon bronze or stainless steel bolts and washers shall be used to install lugs to equipment. Exothermic welding is also allowed.

2.07. GROUNDING BUSBARS FOR LOW VOLTAGE SYSTEMS

- A. Grounding Busbar
 - 1. The grounding busbar shall be made of 1/4" thick solid copper.
 - 2. The grounding busbar shall be installed with minimum clearance, 1" offsets and 1-1/2" insulators.
 - 3. The grounding busbar shall accommodate 2-hole compression lugs.
 - 4. The grounding busbar shall meet or exceed J-STD-607-A requirements.

PART 3 EXECUTION

3.01. INSTALLATION

- A. Ground all non-current carrying parts of the electrical system including raceways, equipment frames and enclosures, outlet boxes, junction boxes, and other conductive material in close proximity with electrical circuits.

- B. Service entrance and separately derived electrical systems, grounding electrode system
1. The grounded conductor(s) of the electrical service serving the premises wiring system shall be connected to the neutral bus bar in the service equipment which shall be grounded to the cold water system, the ground rod system, and other grounding electrodes specified herein or indicated on the Drawings. Grounding electrode conductors shall be installed rigid, nonmetallic conduit to point of ground connection, unless subject to physical damage in which case it shall be installed in galvanized rigid steel.
 2. Make connection to main water line entering the building. Make connections ahead of any valve or fittings whose removal may interrupt ground continuity.
 3. Bond together the following systems to form the grounding electrode system. All system connections shall be made to the electrodes as close as possible to the service entrance equipment and each connected at the service entrance equipment neutral bus. Do not connect electrode systems together except at neutral bus.
 - a. Cold water piping system
 - b. Ground rod system
 - c. Rebar in concrete footing
 - d. Structural steel metal building frame
 4. Ground the neutral of all dry type transformers to either building steel or a common grounding electrode conductor connected to a service ground. Transformers shall be bonded to the nearest available point on the interior water piping system. In reinforced concrete structures building steel shall be considered to be reinforcing steel of vertical columns.
 5. Grounding electrode connections to structural steel, reinforcing bars, ground rods, or where indicated on the Drawings shall be with chemical exothermic weld connection devices (*Cadweld or equal*) recommended for the particular connection type. Connections to piping shall be with UL Listed mechanical ground clamps.
 6. Where there is more than one service to a building or interconnected buildings, services shall be connected by means of a grounding electrode conductor.
 7. Bonding shall be in accordance with the National Electrical Code.

8. Install ground rods where indicated on the Drawings with the top of the ground rods 12 inches below finished grade.
 9. Ground the neutral and frame of the emergency generator to building steel and the main electrical service ground rod system. In reinforced concrete structures building steel shall be considered to be reinforcing steel or vertical columns. Make connection to building steel with chemical weld type connector, in a location in unfinished space where the connection will not be subject to physical abuse.
 10. Generator ground and neutral connections shall be bonded together.
- C. Equipment Grounding Conductor
1. Grounding conductors for branch circuits are not shown on the Drawings; however, grounding conductors shall be provided in all branch circuit raceways and cables.
 2. Grounding conductors for feeders are typically indicated on the Drawings and the raceway is sized to accommodate grounding conductor shown. Where grounding conductor size is not indicated on the Drawings, conductor shall be in accordance with the equipment grounding conductor table of the National Electrical Code.
- D. Other Grounding Requirements
1. Each telephone backboard shall be provided with a No. 6 grounding conductor. When backboard is located in vicinity of electrical service equipment, the "point of grounding" of this conductor shall be the main cold water service with connections made ahead of any valves or joints. Remote backboards shall use building steel as "point of ground." Terminate conductor by stapling to backboard.
 2. At each building expansion joint flexible copper bonding jumpers shall be attached to building structure by chemical weld process. Install bonding jumpers in concealed locations that will not subject connections or jumpers to physical abuse. Install 100' on centers across expansion joints.

3.02. TESTING

- A. Upon completion of the ground rod installation, the Contractor shall test the installation in accordance with the "Electrical Testing" section of Section 16000 - Electrical General. Grounding resistance reading shall be taken before connection is made to the building cold water piping system. Ground resistance readings shall not be taken within 48 hours of rainfall.

3.03. GROUNDING FOR LOW VOLTAGE SYSTEMS

- A. The grounding and bonding system that supports low voltage systems shall be designed in accordance with the recommendations contained in the J-STD-607-A Telecommunications Bonding and Ground Standard.
- B. All telecommunications rooms shall be equipped with a telecommunications ground busbar (TGB). Each TGB shall be connected to the building's electrical ground at the electrical room closest to its proximity.
- C. All wires used for communications grounding purposes shall be identified with green insulation. Non-insulated wires shall be identified at each termination point with a wrap or green tape. All cables and busbars shall be identified and labeled in accordance with the ANSI/TIA/EIA-606-A.

END OF SECTION 16450

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SECTION 16460
DRY TYPE TRANSFORMERS

PART 1 GENERAL

1.01. DESCRIPTION

- A. The work required under this section of the Specifications consists of the furnishing, connection and installation of dry type transformers.

1.02. QUALITY ASSURANCE

- A. The requirements of the following standards shall become a part of this Specification by reference:
1. Underwriters Laboratories Inc. (UL) Publications:
No. 506, 1561: Transformers (1,000 kVA, 3-phase and below; 167 kVA, 1 phase and below)
 2. National Fire Protection Association (NFPA): No. 70: National Electrical Code (NEC)
 3. National Electrical Manufacturers Association (NEMA): No. St-20: Dry-type transformers for general applications
 4. American National Standards Institute (ANSI): No. C89.2
 5. Energy Policy Act of 2005 - Public Law 109-58
- B. Acceptable Manufacturers
1. General Electric
 2. Square D
 3. Siemens
 4. Eaton
- C. Coordination: Coordinate installation with architectural and structural features, equipment installed under other sections of the Specifications to ensure transformer access, clearance minimums, and adequate ventilation are provided.

PART 2 PRODUCTS

2.01. GENERAL MATERIALS REQUIREMENT

- A. Furnish all materials specified herein and indicated on the drawings.

- B. All transformers shall be UL Listed and bear a UL Label.

2.02. GENERAL PURPOSE DRY TYPE TRANSFORMERS

A. Insulation System

1. Single-phase 25-167 kVA and 3-phase 30-500 kVA: Transformers shall be rated for average temperature rise by resistance of 150 degrees C in 40 degrees C maximum ambient, 30 degrees C average ambient. Transformer insulation system shall be UL rated as 220 degrees C system.
2. 3-phase 3-15 kVA: Transformers shall be rated for average temperature rise by resistance of 115 degrees C. Insulation system shall be 180 degrees C.
3. All transformers shall have insulation systems of Class 155 or higher.

- B. Sound rating shall comply with NEMA and ANSI standards for kVA rating. Internal vibration dampening shall be provided for all transformers.

- C. Single-phase transformers rated up to 15 kVA shall have two (2) 5% full capacity taps below normal rated primary voltage. All other single-phase and all 3-phase transformers shall be provided with six (6) 2-1/2% full capacity taps, two (2) above and four (4) below normal voltage, unless only four (4) 2-1/2% taps, two (2) above and two (2) below normal voltage are standard.

D. Construction/Enclosures

1. Transformers 30-1,500 kVA: Transformer enclosures shall be ventilated and drip-proof with removable front and rear cover panels. Transformers shall be suitable for floor mounting, unless wall mounting is indicated on the drawings.
2. Transformers up through 25 kVA: Transformer housings shall be totally enclosed, non-ventilated and drip-proof. Access to wiring compartment shall be permitted via removable panel.

- E. Energy efficiency of transformers shall meet the minimum standard as outlined in NEMA TP-1 tables.

- F. Core assemblies and the center ground point of the coil secondaries shall be grounded to the enclosure by flexible ground straps. Provide grounding lug at the enclosure bonding location for connection of three conductors: the primary and secondary equipment grounding conductors and the grounding electrode conductor.

- G. Transformer coils shall consist of aluminum windings.

PART 3 EXECUTION

3.01. INSTALLATION

- A. Installation shall provide not less than twelve inch clearance from combustible materials and not less than 6" clearance from walls or equipment. Floor-mounted transformers shall be mounted on neoprene, waffle type vibration pads 5/8" thick. Where transformers are mounted on channels angles, transformers shall be bolted to structure with 5/8" thick vibration pad between transformer base and structural channel. 4" thick concrete housekeeping pads shall be used for all floor-mounted transformers.
- B. Provide working clearance and full accessibility for transformer as required by the National Electrical Code.
- C. Primary and secondary connections to dry type transformers shall be made with flexible conduit.
- D. The secondary windings of each dry type transformer shall be grounded in accordance with the National Electrical Code requirements for separately derived electrical systems. Extend a grounding electrode conductor from the transformer grounding lug to the nearest building structural steel and to the nearest available point on the interior water piping system. Connect the primary and secondary feeder, equipment grounding conductors to the grounding lug, also. Refer to the grounding section of these Specifications for additional requirements.

3.02. CLEANING AND ADJUSTMENT

- A. Prior to job completion, clean the interior and exterior of dirt, paint and construction debris.
- B. Touch-up paint scratched surfaces with factory furnished touch-up paint of the same color as the factory applied paint.

END OF SECTION 16460

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SECTION 16500

LIGHTING

PART 1 GENERAL

1.01. DESCRIPTION

- A. This section specifies the lighting system requirements.
- B. All fixtures shall be current source, provided with lamps ready to use.

1.02. RELATED WORK SPECIFIED ELSEWHERE

- A. Refer to another division for the ceiling systems.
- B. Lighting system shall be coordinated with the ceilings.

1.03. SUBSTITUTIONS/VALUE ENGINEERING/PRICING

- A. Substitution/value engineering requests shall be accompanied by complete manufacturers data with model numbers, cut sheets with options indicated, and a full photometric report. For exterior lighting, a computer generated point by point calculation shall be provided.
- B. All substitution requests shall be submitted in completion to Engineer at least 10 days prior to bid date.

PART 2 PRODUCTS

2.01. BALLASTS

- A. All fluorescent lamp ballasts shall be low-loss, high power factor Class "P," with "A" sound rating and shall bear UL and CBM certifications. Ballast case temperature shall not exceed 90 degrees C.
- B. All fluorescent fixtures shall be equipped with program-start ballasts. Multi-lamp ballasts shall be parallel-wired.
- C. Linear and compact fluorescent lamp ballasts shall be electronic by Advance, General Electric, Osram Sylvania, or Universal.
- D. All HID lighting fixtures shall have a high power factor, regulated output ballast provided by the fixture manufacturer, pre-wired with a glass tube fuse holder and fuse on each primary hot lead.

2.02. LAMPS

- A. Fluorescent lamps shall be energy saving type, 3,500 degrees K, CRI 75, of size and wattage as scheduled on the Drawings, unless noted otherwise on

Light Fixture Schedule. They shall be General Electric or equal as manufactured by Sylvania or Philips unless indicated otherwise on Drawings. Lamps shall have a rated life of 20,000 hours minimum at three (3) hours per start.

- B. Incandescent lamps shall be of type, size and voltage as scheduled on the Drawings. Lamps shall be of the extended service type with a rated life of 2,500 hours. Reflector lamps (R and PAR) shall have a rated life of 2,000 hours for the standard type and 4,000 hours for the "Quartz" or "Krypton" types. Quartz lamps shall be clear with a rated life of 2,000 hours.
- C. HID lamps shall be of type, size and voltage as scheduled on the drawings. They shall be General Electric or equal as manufactured by Sylvania or Philips unless otherwise on Drawings. Lamps shall have a rated life of 24,000 hours minimum at a ten (10) hours per start.
- D. LED shall be of type, size and voltage as scheduled on the drawings and suitable for the application. LEDs shall have a rated life of 50,000 hours minimum. Color shall be 4,000 K or warmer. LED drivers shall be a minimum or 85% efficient with a power factor .90 or greater.

2.03. LIGHTING FIXTURES

- A. Letter designations beside outlet symbols on Drawings correspond to letter designations in Lighting Fixture Schedule.
- B. Recessed incandescent fixtures, where used in an insulated ceiling, shall be equipped with thermal protection and shall bear the UL Label indicating the suitability for such use.
- C. Lens material for recessed fluorescent fixtures shall be 100% virgin acrylic, 0.125" thick in a square prism pattern similar to KSH-K-12 or as scheduled in Lighting Fixture Schedule.
- D. Site lighting poles shall meet or exceed the local wind loading requirements of authority having jurisdiction.
- E. Concrete pole bases shall be required for site lighting poles.
- F. Recessed lighting fixtures installed in the building thermal envelope (e.g. attic) shall be IC rated and labeled with enclosures that are sealed and gasketed to limit air leakage between conditioned and non-conditioned spaces.
- G. All linear fluorescent lighting fixtures (with double-ended lamps) shall have a factory-installed, concealed disconnecting means for each ballast.

PART 3 EXECUTION

3.01. LIGHTING FIXTURES

- A. Provide lighting fixtures at all locations indicated by distinctive symbols or notes on the Drawings.
- B. Lighting fixtures shall be secured to ceiling grid with clips or screws and two #12 steel wires mounted to opposite corners of light fixture secured to structure.
- C. Locations of lighting fixtures on the electrical drawings are approximate. Refer to Architectural reflected ceiling plan for actual locations of fixtures and mounting heights.
- D. Lighting fixtures installed in plaster and stucco ceiling shall have plaster frame and shall be of the flanged type.
- E. Fixtures recessed in concealed-spline tile and in gypsum board ceilings shall be flanged.
- F. Surface or recessed fixtures in or on plastered ceilings shall be supported from pieces of support channel spanning across the main supporting channels and shall not depend on the metal lath for support.
- G. Each recessed lighting fixture shall have a trim to match the type of ceiling (exposed grid, metal panel, etc.) in which it is being installed, except where noted otherwise on the plans.
- H. Each lighting fixture recessed in a concrete wall shall have a junction box or wiring compartment provided inside the fixture housing. Provide conduit access into the fixture concealed.
- I. Warehouse light fixtures shall be suspended from support channel attached to steel roof joists. Provide chain hanging assemblies as required to support fixture and wiring. Refer to details on drawings.

END OF SECTION 16500

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SECTION 16510

LIGHTING CONTROL SYSTEM – RELAY PANELS

PART 1 GENERAL

1.01. INTRODUCTION

- A. The work covered in this section is subject to all of the requirements in the General Conditions of the Specifications. The Contractor shall coordinate all of the work in this section with all of the trades covered in other sections of the specification to provide a complete and operable system.

1.02. SYSTEM DESCRIPTION

- A. Install a low voltage switching system consisting of relay panels and intelligent switches connected together by a dataline, as well as all associated wiring.
- B. The system includes a DIN rail-mounted automation module, photocontrol module and/or other low voltage control devices. These devices are totally compatible with the manual operation of the dataline switches.
- C. Requirements are indicated elsewhere in the specifications for work including, but not limited to, raceways and electrical boxes and fitting required for installation of control equipment and wiring.

1.03. QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years. Manufacturer shall be ISO 9001 certified.
- B. Component Pre-testing: All components and assemblies are to be factory pre-tested prior to installation.
- C. System Support: Factory applications engineers shall be available for telephone support.
- D. NEC Compliance: Comply with NEC as applicable to electrical wiring work.
- E. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.
- F. UL Approvals: Remote panels are to be UL Listed under UL 916 Energy Management Equipment.

- G. FCC Emissions: All assemblies are to be in compliance with FCC emissions Standards specified in Part 15 Subpart J for Class A application.

1.04. SUBMITTALS

- A. Shop Drawings: Submit dimensional drawings of all lighting control system components and accessories.
- B. One-Line Diagram: Submit a one-line diagram of the system devices and cabling.
- C. Typical Wiring Diagrams: Submit typical wiring diagrams for all components including, but not limited to, relay panels, relays, low voltage dataline switches, occupancy sensors and daylighting controls.

1.05. MANUFACTURERS

- A. Acceptable manufacturers for lighting control system are Watt Stopper, Lighting Control & Design and Square D Clipsal.

PART 2 MATERIALS AND COMPONENTS

2.01. SMARTWIRED SWITCHING (SWS) RELAY PANELS

- A. Description: Modular Relay Panels shall be UL Listed and consist of the following:
 - 1. Tub: Empty NEMA 1 enclosure that can accept an interior sized to accept up to 12, 24, or 48 mechanically latching relays.
 - 2. Power Supply: As required
 - 3. Cover: Surface or flush as required, with captive screws in a hinged, lockable configuration.
 - 4. Interior: Interiors shall be provided with up to 12, 24, or 48 installed and tested relays as shown on the Drawings.
 - 5. Panel shall be provided with provisions for additional components, data connections, etc.
- B. Features
 - 1. Relays shall be momentary-pulsed mechanically latching contactors with plug in connector. Relays shall have mechanically latching contacts with single moving part design for improved reliability. Relays will have the following characteristics:
 - a. Coil
 - 1) Magnetically held, momentary coil activation (50 milliseconds).

- 2) 2.2 VA max per relay to allow up to 20 relays to be controlled in parallel using class 2 wiring.
- b. Power Contacts
 - 1) 20 amp tungsten and NEMA electronic ballast rated.
 - 2) Rated for 50,000 ON/OFF cycles at full load.
 - 3) Support #10 - #14 WG solid or stranded wire.
 - 4) 120, 277 and 347 volt rated.
 - 5) Standard 1 year warranty.
- c. 30 VAC isolated contacts for status feedback and pilot light indication.
- d. FCC approved for commercial and residential use.
2. Next to each relay shall be an individual override button and a bi- color LED to indicate status.
3. Panels shall support the “blink warning” function, with LED indication for each relay.
4. Captive screw terminations will be provided for all wiring connections.
5. Each channel button’s dry control contact input terminal shall accept either 2 or 3-wire, maintained or momentary inputs. They shall also accept a 2-wire toggling input.
6. Each channel shall also have an associated 1 amp, 30 VDC isolated contact which may be used for status feedback or pilot light control.
7. The unit shall provide LED status indication of the power supply status. Access to 24VAC and 24V rectified power for accessory devices shall be provided within the panel.
8. The panel shall have an integrated DIN rail for mounting dataline control modules.
- C. Optional: Interior shall use relays with an optional pilot contact to provide individual relay feedback to other control systems. Terminal blocks shall be located next to each relay to allow standard low voltage switching devices to control the relay state. Devices can be either 2 or 3-wire, maintained or momentary inputs. They shall also accept a 2-wire toggling input.

2.02. NETWORK DATALINE

A. Description

1. The intelligence in multiple panels shall be linked over a single dataline.

2. The dataline, in addition to linking together multiple relay panels, shall be capable of extending out from the electrical closet, and provide a single communications bus to allow dataline switches to communicate with the panels.
3. The dataline can also connect to a single network clock or a single BMS interface module mounted in the interior of a relay panel or a separate enclosure.

B. Features

1. Dataline shall be 18 AWG, 4 unshielded copper conductors (two independent twisted pairs) meeting Class 2P NEC code requirements. The dataline can be run in a loop, serial, or star configuration. Minimum 1 turn per 3 inches; capacitance 30pF/foot max.
2. Maximum length for all dataline wire in the system is 1,500 feet without repeaters.
3. Maximum number of dataline devices (panels/switch units/ controllers) is 64 without a repeater.

2.03. IDENTIFICATION

A. Description

1. To allow individual overrides, dataline switches shall be terminated to each panel's 4-wire local dataline. Switches shall be available in single, dual, quad, or octal (1-button, 2-button, 4-button, or 8- button) designs. The single, dual, and quad devices shall mount in a standard single gang box; the octal version in a two-gang box.
2. Each button in a switch module can be individually programmed. Each button can control any one of the following options:
 - a. Any individual relay in any single panel.
 - b. Any group of relays in any single panel.
3. For special applications see Drawing notes.

B. Features

1. Provide switches as shown on the Drawings for overrides, and programmed for specific applications such as:
 - a. Blink notice
 - b. Cleaning Scenario
 - c. Parallel operation

2. Back Lit LEDs as required

2.04. NETWORK CLOCK

A. Description

1. Provide a network clock. Network clock can be used to schedule timed scenarios vs. digital input signals.
2. Astronomical type time clock to be included.

2.05. SMARTWIRED PHOTOCONTROL MODULE

A. Description

1. A single photocell shall be mounted in an appropriate location for measuring exterior light levels. The sensor shall connect to a separate photocontrol module via the local dataline, which provides power to the unit. No extra wires shall be required.
2. The photocontrol module shall be designed to integrate seamlessly with either the network clock or the BMS interface module.
3. The photocontrol module shall measure the actual exterior light level. Each of the eight global channels shall have the ability to be assigned a different trip level.

2.06. BMS INTERFACE MODULE

- A. Description: The BMS interface module shall be used in lieu of the network clock to provide the same lighting control functions (with the exception of the astronomic function), but shall allow an external automation device to provide the signal that changes channel status from “occupied” to “unoccupied” (after-hours).
- B. Features: Automatically detects the presence of the photocontrol module on the dataline and adds the dark scenarios to the menus, accepting actual light level readings for the following scenarios:
1. Dark ON/Dark OFF
 2. Dark ON/Schedule OFF

2.07. TELEPHONE CONTROL MODULE

- A. Description: The telephone control module shall allow building occupants to override the lighting on or off using a touch-tone telephone.

2.08. UNIVERSAL SWITCH INTERFACE MODULE

- A. Description: Provide a universal switch interface module to wire non- dataline switches to the SWS network or to accept contact closures from other systems.

2.09. AUTOMATIC CONTROL SWITCH

- A. Description
 - 1. The automatic control switch shall be a line voltage, push-button wall switch capable of ON/OFF manual operation and also of receiving control signals through the temporary interruption of power to the circuit via the relay panel.
 - 2. Occupants shall have a five-minute time delay to press the switch, keeping the lights on until the end of the next sweep interval.
- A. Features
 - 3. 120 VAC or 277 VAC models with matching wall plate included.
 - 4. Audible beep during time delay can be enabled or disabled without removing the switch face plate.
 - 5. Locator LED.

2.10. ACCESSORY ENCLOSURE

- A. Description: Provide an Accessory Enclosure with integral DIN rail mounting area and connections for dataline and optional power supply as needed for remote mounting of intelligence modules.

PART 3 EXECUTION AND SUPPORT SERVICES

3.01. INSTALLATION

- A. Dataline switches and/or photocells shall be mounted in the spaces as indicated on the Reflected Ceiling Plans. Each low voltage wire shall be labeled clearly indicating which relay panel it connects to. Use only properly color-coded, stranded #18 AWG (or larger) wire as indicated on the Drawings. All relays and switches shall be tested after installation to confirm proper operation, and all connected loads shall be recorded on the relay schedule for each panel.
- B. The relay panels shall be mounted in electrical closets as indicated on the Drawings. The numbered relays in the panel shall be wired to control the power to each load as indicated on the Panel Wiring Schedules included in the Drawings. All power wiring will be identified with the circuit breaker

number controlling the load. If multiple circuit breaker panels are feeding into a relay panel, wires shall clearly indicate the originating panel's designation.

3.02. CONTRACTOR PROVIDED INFORMATION

- A. The Contractor shall provide system documentation after the equipment has been installed.
 - 1. Relay Panels: Panels shall be numbered consecutively beginning at #01 as shown on the Drawings. Individual relay load descriptions and the channels to which they are smartwired shall be recorded on the SWS Relay Schedule form provided with each panel.
 - 2. Intelligent Dataline Switches: Each intelligent switch on a relay panel's local dataline shall be numbered consecutively beginning with #01. This switch designation shall be recorded on the label provided on the front of the switch unit, under the wall plate. (For example, the switches connected to relay panel #02 would be numbered 02-01, 02-02, 02-03, etc.). The relays (or channels) controlled by each switch shall be recorded on the "SWS Switch Documentation" form provided with the relay panel.
 - 3. Network Clock (or BMS Interface): The automation scenarios and operating data for each of the eight channels shall be recorded on the "Network Clock Automation Scenarios" form or "BMS Interface Automation Scenarios" form provided with the network clock or BMS interface module.
 - 4. System installation and operation manual shipped with the network clock or BMS interface module shall be provided to the Owner.

3.03. DOCUMENTATION

- A. Manufacturer shall provide system documentation including:
 - 1. System 1-line showing all panels, number and types of switches and sensors, dataline, and network timeclock of BAS interface unit.
 - 2. Drawings for each panel showing hardware configuration and numbering.
 - 3. Panel wiring schedules.
 - 4. Typical wiring diagrams for each component.

3.04. WARRANTY

- A. Manufacturer shall provide a 1-year warranty for all system components.

3.05. SYSTEM STARTUP

- A. Manufacturer shall provide a factory authorized to confirm proper installation and operation of all system components.

3.06. TRAINING

- A. Manufacturer shall provide factory authorized application engineer to train Owner personnel in the operation and programming of the lighting control system.

END OF SECTION 16510

SECTION 16520
OCCUPANCY SENSORS

PART 1 GENERAL

1.01. WORK INCLUDED

- A. The Contractor's work shall include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.
- B. The Contractor/supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 16.
- C. The Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, fixtures, HVAC systems and building management systems.

1.02. EQUIPMENT QUALIFICATION

- A. Products supplied shall be from a single manufacturer that has been continuously involved in the manufacturing of occupancy sensors for a minimum of five (5) years. Mixing of manufacturers shall not be allowed.
- B. All components shall be UL Listed, offer a 5-year warranty and meet all state and local applicable code requirements.
- C. Products shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.
- D. Wall switch products must be capable of withstanding the effects of inrush current. Submittals shall clearly indicate the method used.

1.03. SYSTEM DESCRIPTION

- A. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.
- B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.
- C. The Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications. The supplier's obligation shall include repair or replacement, and testing without charge to the Owner, all or

any parts of equipment which are found to be damaged, defective or non-conforming and returned to the supplier. The warranty shall commence upon the Owner's acceptance of the project. Warranty on labor shall be for a minimum period of one (1) year.

1.04. SUBMITTALS

- A. Manufacturer shall substantiate conformance to this specification by supplying the necessary documents, performance data and wiring diagrams. Any deviations to this specification must be clearly stated by letter and submitted.
- B. Submit a lighting plan clearly marked by manufacturer showing proper product, location and orientation of each sensor.
- C. Submit any interconnection diagrams per major subsystem showing proper wiring.
- D. Submit standard catalog literature which includes performance specifications indicating compliance to the specification.
- E. Catalog sheets must clearly state any load restrictions when used with electronic ballasts.

1.05. SYSTEM OPERATION

- A. It shall be the Contractor's responsibility to make all proper adjustments to assure Owner's satisfaction with the occupancy system.

1.06. ACCEPTABLE MANUFACTURERS

- A. The Watt Stopper, or Pre-Approved Equal: For pre-approval, provide all the information listed under section 1.04 A and 1.04 D a minimum of ten (10) working days prior to initial bid date.
- B. The listing of any manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the electrical contractor to ensure that any price quotations received and submittals made are for sensors which meet or exceed the specifications included herein.

PART 2 PRODUCTS

2.01. GENERAL

- A. All products shall be Watt Stopper product numbers.
 - 1. Ceiling Sensors: WT-605, WT-600, WT-1105, WT-1100, WT-2205, WT-2200, WT-2250, WT-2255, W-500A, W-1000A, W-2000A, W-2000H, WPIR, DT-200, DT-205, CX-100, CX-105, CI-200, CI-205.

2. Wall Sensors: WI-200, WS-120/277, WA-100, WD-170, WD-180, WD-270, WD-280.
 3. Power and Slave Packs: B120E-P, B277E-P, C120E-P, C277E-P, S120/277-P, AT-120.
 4. HID Control: DM-100.
 5. Outdoor Sensors: EW-100, EW-200, EN-100, EN-200.
 6. Low Temperature: CB-100.
 7. InteleSwitch: TS-200, TS-300, TS-200-24.
- B. Wall switch sensors shall be capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet.
 - C. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1,200 watts at 277 volts and shall have 180 degrees coverage capability.
 - D. Wall switch products shall utilize Zero Crossing Circuitry, which increases relay life, protects from the effects of inrush current, and increases sensor's longevity.
 - E. Wall switch sensors shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.
 - F. Where specified, wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-ON to manual-ON.
 - G. Where specified, vandal resistant wall switch sensors shall utilize a hard lens with a minimum 1.0 mm thickness. Products utilizing a soft lens will not be considered.
 - H. Passive infrared sensors shall utilize Pulse Count Processing and Digital Signature Analysis to respond only to those signals caused by human motion.
 - I. Passive infrared sensors shall utilize mixed signal ASIC which provides high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line), superior performance, and greater reliability.
 - J. Passive infrared sensors shall have a multiple segmented Lodif Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up.
 - K. Where specified, passive infrared and dual technology sensors shall offer daylighting footcandle adjustment control and be able to accommodate dual level lighting.

- L. Dual technology sensors shall be corner mounted to avoid detection outside the controlled area when doors are left open.
- M. Dual technology sensors shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.
- N. Ultrasonic sensors shall utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.
- O. Ultrasonic operating frequency shall be crystal controlled at 25 kHz within + 0.005% tolerance, 32 kHz within + 0.002% tolerance, or 40 kHz + 0.002% tolerance to assure reliable performance and eliminate sensor crosstalk. Sensors using multiple frequencies are not acceptable.
- P. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.
- Q. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
- R. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Setting shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.
- S. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.
- T. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.
- U. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.
- V. All sensors shall have UL rated, 94V-0 plastic enclosures.
- W. Outdoor motion sensors shall have UL 773A ratings. EWF outdoor sensors shall additionally have UL 1571 ratings.
- X. EW-100 outdoor sensors shall cover up to 35 feet, with a field of view of 180 degrees. EW-200 outdoor sensors shall cover up to 52.5 feet, with a field of view of 270 degrees. EN-100 outdoor sensors shall cover up to 35 feet, with a

field of view of 90 degrees. EN-200 outdoor sensors shall cover up to 100 feet, with a long range lens view.

- Y. EWF outdoor sensors shall include polycarbonate lamp holders that accept PAR 20 or 38 lamps up to 150W per lamp.
- Z. Outdoor sensors shall have an operating temperature range of -40 degrees F to +130 degrees F.
- AA. To ensure complete protection from weather elements and exposure, outdoor sensors shall be manufactured with precision double-shot tooling and contain internal silicon gaskets.

2.02. CIRCUIT CONTROL HARDWARE – CU

- A. Control Units: For ease of mounting, installation and future service, control unit(s) shall be able to externally mount through a 1/2" knock-out on a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Control unit shall provide power to minimum of two (2) sensors.
- B. Relay Contacts shall have rating of:
 - 1. 13A - 120 VAC Tungsten
 - 2. 20A - 120 VAC Ballast
 - 3. 20A - 277 VAC Ballast
- C. Control wiring between sensors and controls units shall be Class II, 18-24 AWG, stranded UL Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.
- D. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

PART 3 EXECUTION

3.01. INSTALLATION

- A. It shall be the Contractor's responsibility to locate and aim sensory in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have 90 to 100% coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The Contractor shall

provide additional sensors if required to properly and completely cover the respective room.

- B. It is the Contractor's responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative, at the Owner's facility, to verify placement of sensors and installation criteria.
- C. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The Contractor shall also provide, at the Owner's facility, the training necessary to familiarize the Owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

3.02. COMMISSIONING

- A. Upon completion of the installation, the system shall be completely commissioned by the contractor who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control system.
- B. The electrical contractor shall provide the Owner's representative with ten (10) working days written notice of the scheduled commissioning date. Upon completion of the system fine tuning, the contractor shall provide training to the Owner's personnel in the adjustment and maintenance of the sensors.

END OF SECTION 16520

SECTION 16750

LOW VOLTAGE BACKBOARDS & ENCLOSURES

PART 1 GENERAL

1.01. GENERAL REQUIREMENTS

- A. Applicable requirements of Section 16000 - Electrical General shall be considered a part of this section and shall have the same force as if printed herein full.
- B. This document describes the products and execution requirements relating to backboards.
- C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and/or on the Drawings.

1.02. WORK INCLUDED

- A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.
- B. The work shall include, but not be limited to the following:
 - 1. Furnish and install all backboards.

PART 2 PRODUCTS

2.01. APPROVED PRODUCTS

- A. Approved Equipment Backboard Manufacturer(s)
- B. Hoover – ¾" Pyro-Guard B/C grade plywood
- C. Standard ¾" Plywood (treated with fire-retardant paint) B/C grade

PART 3 EXECUTION

3.01. BACKBOARDS

- A. Backboards shall be ¾" void free plywood. Size of backboard shall be 4' x 8' unless noted differently on Drawings. Backboards shall be painted with two (2) coats of gray fire-retardant paint.

END OF SECTION 16750

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