


KRH ARCHITECTS

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A New VISITOR'S PRESSBOX for:
CARTERSVILLE HIGH SCHOOL
for the
CARTERSVILLE CITY SCHOOL DISTRICT

ADDENDUM:

JOB NO.: 17-008 DATE ISSUED: 04/07/17 SET NO.: _____

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CARTERSVILLE CITY SCHOOL DISTRICT

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SECTION 00010 - REQUEST FOR PROPOSALS

THE CARTERSVILLE CITY SCHOOL DISTRICT, BOARD OF EDUCATION (the "Board"), pursuant to the provisions of O.C.G.A. § 36-91-1, *et. seq.*, herein seeks competitive proposals from general contractors for the construction of A New Visitor's Press Box for Cartersville High School located at 320 E. Church Street, Cartersville GA 30120 (the "Project").

The requirements for construction of the Project, and the duties and responsibilities of the contractor whose Proposal is accepted, are set forth in the Contract Documents which include the Instructions to Proposers; Contract for Construction and Incorporated General Conditions (the "Contract"); supplementary and other conditions; the drawings; the specifications; and, any addenda issued by the Architect. Contractors interested in submitting Proposals must obtain copies of the Contract Documents by contacting the Project Architect, KRH Architects, 855 Abutment Road, Suite 4, Dalton, Ga. 30721.

Any contractor submitting a Proposal must procure a complete set of the Contract Documents from the Project Architect. Contract Documents will be issued in PDF format to contractors registered with the office of the Architect at no cost. Printed copies are available for \$100.00 per set (not including shipping or delivery fees). Payment must be made by certified check, treasure's check, or cashier's check, issued by a responsible bank or trust company, payable to the Architect. The Architect will also make available the Proposal Form as well as the Contractor's Qualification Statement which must be fully completed and submitted with any Proposal. These documents are available for inspection by the public at the office of the Architect identified above. The Contract Documents require, among other things, the furnishing of all materials, labor and equipment for construction of the Project. The Board reserves the right to make available other relevant documents or information concerning the Project.

Any Contractor who intends to submit a Proposal is required to attend a Pre-proposal Meeting, which will be held on the 25th day of April, 2017, at 2:00 p.m. at the offices of Cartersville City School District Cartersville City Schools 15 Nelson Street Cartersville, GA 30120

Any Proposal submitted in response to this Request should comply strictly with all requirements set forth in the Instructions to Proposers. Any such Proposal must contain the completed Proposal Form setting forth the contractor's proposed lump sum contract price for full and complete construction of the Project in conformity with all requirements of the Contract Documents. Any Proposal must include a fully executed Bid Bond in the amount of five percent (5%) of the proposed lump sum contract price (exclusive of any alternates and unit prices) in the form required by the Instructions to Proposers.

In evaluating Proposals, the Board may seek additional information from any contractor concerning such contractor's Proposal.

The Board intends to award the construction contract to the responsible and responsive contractor whose Proposal is determined in writing to be the most advantageous to the Board,

taking into consideration the following evaluation factors which are listed in their order of relative importance:

- (A) The contractor's proposed lump sum contract price for full and complete construction of the Project in conformity with all requirements of the Contract Documents. (55 Points)
- (B) The contractor's prior experience in constructing similar projects on schedule and within budget including at least two projects comparable in size and scope to this project. For purposes of this factor, the Project should not be more or less than 30 percent in scope or cost than the similar projects identified by contractor. (50 Points)
- (C) The qualifications and experience of those personnel whom the contractor will assign to the Project. (35 Points)
- (D) The completeness and accuracy of proposals (25 Points)
- (E) The contractor's history of successfully constructing projects without unnecessary contractual disputes, claims, arbitration or litigation. (25 Points)

All Proposals must be properly signed, submitted in bound notebooks, and received by the Board at its offices located at 15 Nelson Street Cartersville, GA 30120, no later than 10:00 a.m. on the 8th day of May, 2017.

Two proposals in bound notebooks are required. The Board will receive such Proposals at such time and place. Proposals attempted to be delivered after said time will not be accepted. At the discretion of the Board, and in conformity with the applicable provisions of Georgia Law, the Board may afford contractors an opportunity for subsequent discussion, negotiation, and revision of Proposals. The Board reserves the right to reject any or all Proposals and to waive any technicalities or formalities.

Any Proposal must include an affidavit meeting all requirements of O.C.G.A. § 13-10-91 verifying compliance with applicable Federal work authorization program. The form for such affidavit is attached as an exhibit to the **INSTRUCTION TO PROPOSERS.**

Any Proposal submitted in response to this Request shall remain open for acceptance by the Board, and same shall be honored by the contractor, for a period of sixty (60) days from the date set forth hereinabove for the receipt of Proposals.

Any questions or comments concerning this Request for Proposals should be addressed in writing to the Architect at the address as set forth hereinabove.

Cartersville City School District,
Board of Education

SECTION 00020 - INSTRUCTIONS TO PROPOSERS

THE CARTERSVILLE CITY SCHOOL DISTRICT, BOARD OF EDUCATION (the “Board”), pursuant to the provisions of O.C.G.A. § 36-91-1, *et. seq.*, herein seeks competitive proposals from general contractors for the construction of A New Visitor’s Press Box for Cartersville High School located at 320 E. Church Street, Cartersville GA 30120 (the “Project”). Any Proposer submitting a Proposal (a “Contractor”) in response to the aforesaid Request for Proposals shall comply with the following specific instructions:

- (1) The submission of a Proposal constitutes an acknowledgment and representation by the Contractor that it has visited the Project site and has familiarized itself with the local conditions under which the required Work is to be performed and it further represents that such conditions have been fully considered by the Contractor in its proposed lump sum contract price;
- (2) The submission of a Proposal constitutes a representation by the Contractor that it has studied and examined the Contract Documents and such other information as may have been furnished by the Board or the Architect. Furthermore, the submission of a Proposal constitutes a representation by the Contractor that it has no knowledge of any ambiguities, errors, omissions or other inaccuracies in any of the Contract Documents or material furnished by the Board or Architect in connection with the Project;
- (3) Any Proposal must include a fully completed Contractor’s Qualification Statement and Questionnaire in the form attached hereto as Exhibit “A”;
- (4) Any Proposal may include such documentation and information as the Contractor deems appropriate to establish that it is a responsible and responsive Contractor and that its Proposal is the most advantageous to the Board, taking into consideration the specific evaluation factors, listed in their order of relative importance, as set forth in the aforesaid Request for Proposals;
- (5) Any Proposal must include a fully executed Bid Bond in the form attached hereto as Exhibit “D” in the amount of five percent (5%) of the lump sum contract price (exclusive of any price for Alternates or unit prices). Required Payment and Performance Bond forms will be furnished by the Architect and are required to be submitted by the Contractor in accordance with the requirements of the Contract

Documents. Such Payment and Performance Bonds shall each be in the amount of one hundred percent (100%) of the lump sum contract price as set forth in the Agreement between the Board and the Contractor;

- (6) Any Contractor who intends to submit a Proposal is required to attend a Pre-proposal Meeting, which will be held on the 25th day of April, 2017, at 2:00 p.m. at the offices of Cartersville City School District Cartersville City Schools 15 Nelson Street Cartersville, GA 30120
- (7) The Architect will give consideration, prior to submission of Proposals, to requests for approval of products similar to those specified by proprietary names provided only that such requests comply with the following provisions:
 - (a) All requests for substitution must be written and delivered to the office of the Architect at least fourteen (14) calendar days prior to the date required for the submission of Proposals;
 - (b) Any requests for substitution must identify the product for which substitution is requested by brand name and/or catalog number, together with Section and Article number where specified, and must identify in similar manner the proposed substitution;
 - (c) Any requests for substitution must explain fully the difference, if any, between the proposed substitution and products specified, including but not limited to, physical color, function, and guarantee considerations;
 - (d) Any requests for substitution must be accompanied by technical data, including laboratory tests, if applicable, on the proposed substitution;
 - (e) Any requests for substitution must give complete information on changes, if any, to drawings or specifications which will be necessary or advisable if the substitution is approved;
 - (f) Any requests for substitution must identify three (3) projects wherein the proposed substitution has been utilized and such identification must include the name, address, and telephone

number of such projects' owners, architects and general contractors.

Separate requests shall be made for each proposed substitution save and except where multiple substitutions are related to a complete assembly, such substitutions may be addressed in a single request. The Architect will review requests for substitution submitted in accordance with the above requirements and if in the sole discretion of the Architect such substitution is in the Board's interest, he will, by addendum, add the substitution to the applicable specification.

- (8) All Questions shall be submitted to the office of the Architect in writing. All questions must be received by the Architect no later than five (5) days prior to the hour set to receive proposals. All questions will be answered in writing and included in the addenda. Any changes, additions, interpretations, or corrections, to or concerning the Contract Documents prior to the date for submission of Proposals will be issued as an Addendum by the Architect. Only such written changes, additions, interpretations, or corrections by Addendum shall be binding. Any changes, additions, interpretations, or corrections given by any other method shall not be valid and the Contractor shall not rely upon in any manner whatsoever any verbal statements, instructions, interpretations, corrections, or other information provided by the Board or the Architect or their representatives. Addendum will be sent by email to all Contractors and other entities who are registered in the office of the Architect as having received Contract Documents for the Project. Such Addendum will be emailed to the addresses as furnished by such Contractors or entities;
- (9) All Proposals must be signed by a duly authorized officer, member, or general partner (as appropriate) and dated. All blanks on the Proposal Form shall be filled in and numbers shall be written in English words and in Arabic numerals where so requested. The completed Proposal shall be without interlineations, alterations or erasures. Addenda must be acknowledged where so designated and the Proposal shall include a proposed price for all Alternates and units. In the event a Contractor does not desire to make a change in its Proposal for any given Alternate, it shall so indicate by using the words "No Change". All Proposals

must be submitted in a bond Note Book (2 copies) and received by the Board at its offices located at 15 Nelson Street Cartersville, GA 30120, no later than 10:00 a.m. on the 8th day of May, 2017. The Board will receive such Proposals at such time and place;

- (10) At the discretion of the Board, and in conformity with the applicable provisions of Georgia Law, the Board may afford Contractors an opportunity for subsequent discussion, negotiation, and revision of Proposals. The Board reserves the right to reject any or all Proposals and to waive any technicalities or informalities. Incomplete or irregular Proposals, and Proposals submitted without the required Bid Bond, may be rejected by the Board;
- (11) Prior to commencing any Work on the Project, any Contractor selected by the Board shall execute a written oath in accordance with the provisions of O.C.G.A. § 36-91-21(e) affirming that it has not prevented, or attempted to prevent, competition in connection with the submission of Proposals to the Board by any means whatever nor has it prevented, or endeavored to prevent, anyone from submitting a Proposal by any means whatever nor has it caused or induced another to withdraw a Proposal for the Work in issue;
- (12) Any Proposal must be submitted to the Board on the Proposal Form attached hereto as Exhibit "E" and same shall be executed under oath by an officer, partner, or member of the Contractor. Any Proposal must include an affidavit meeting the requirements of O.C.G.A. § 13-10-91 verifying compliance with applicable Federal work authorization program. The form of such affidavit is attached hereto as Exhibit "F";
- (13) Upon submission, all Proposals shall become and remain the property of the Board. The Board shall have no liability arising out of the disclosure, dissemination, or publication of any Proposal or any information contained therein;
- (14) Any Proposal submitted to the Board shall remain open for acceptance by the Board, and same shall be honored by the Contractor, for a period of sixty (60) days from the date set forth hereinabove for the receipt of Proposals;

- (15) The Board reserves the right to amend these Instructions, or clarify same by Addendum, within the time provided by Georgia Law. If such revisions or amendments are of such magnitude as to warrant, in the sole discretion of the Board, the postponement for the date of the submission and receipt of Proposals, written notification shall be issued to any Contractor who has notified the Board in writing of its intent to submit a Proposal pursuant to the Board's Request for Proposals.

AFFIDAVIT - EXHIBIT "F"

The Undersigned, after being duly sworn, deposes and states as follows:

1.

The Undersigned is over the legal age of majority and is duly competent to execute this Affidavit. The Undersigned is _____ of _____, a general contractor (hereinafter "Contractor"), which maintains its principal place of business at _____. The Undersigned is expressly authorized to execute this Affidavit on behalf of Contractor. The Undersigned has personal knowledge of all facts set forth herein and said facts are true and correct. This Affidavit is executed in accordance with the provisions of O.C.G.A. § 13-10-91 and is submitted in connection with Contractor's proposal to construct for the City of Cartersville, Board of Education (hereinafter "the Board") a project known as _____ (hereinafter "the Project").

3.

The Undersigned affirms and attests that Contractor has registered with, is authorized to use, and uses the federal work authorization program as said program is defined in the above-referenced provision of Georgia law. The user identification number of Contractor for said program is _____ and the date of authorization for Contractor to use said program is _____. In the event Contractor is awarded a contract for the Project, it will continue to use the federal work authorization program throughout the contract period.

4.

In the event Contractor is awarded a contract for the Project, it will contract for the physical performance of services in satisfaction of such contract only with subcontractors who present an affidavit to Contractor with the same information required in Paragraph 3 hereinabove.

Executed this _____ day of _____, 20____.

Contractor: _____

By: _____

Title: _____

Sworn and subscribed before me
this _____ of _____, 20____.

NOTARY PUBLIC
Commission Expiration

SECTION 00030 - CONTRACTOR'S QUALIFICATION STATEMENT AND QUESTIONNAIRE

EXHIBIT "A"

NAME OF PROJECT: A NEW VISITOR'S PRESS FOR: CARTERSVILLE HIGH SCHOOL

NAME OF OWNER: CARTERSVILLE CITY SCHOOL DISTRICT, BOARD OF EDUCATION

NAME OF PROPOSED CONTRACTOR:

(The "Contractor")

I. INSTRUCTIONS

- A. ALL QUESTIONS ARE TO BE ANSWERED IN FULL, WITHOUT EXCEPTION. IF COPIES OF OTHER DOCUMENTS WILL ANSWER THE QUESTION COMPLETELY, THEY MAY BE ATTACHED AND CLEARLY LABELED. IF ADDITIONAL SPACE IS NEEDED, ADDITIONAL PAGES MAY BE ATTACHED AND CLEARLY LABELED.
- B. THE OWNER, THE CARTERSVILLE CITY SCHOOL DISTRICT, BOARD OF EDUCATION (HEREINAFTER "OWNER"), ITS AGENTS AND REPRESENTATIVES, SHALL BE ENTITLED TO CONTACT EACH AND EVERY REFERENCE LISTED IN RESPONSE TO THIS QUESTIONNAIRE, AND EACH ENTITY REFERENCED IN ANY RESPONSE TO ANY QUESTION IN THIS QUESTIONNAIRE. THE CONTRACTOR, _____, (HEREINAFTER "CONTRACTOR"), BY COMPLETING THIS QUESTIONNAIRE, EXPRESSLY AGREES THAT ANY INFORMATION CONCERNING THE CONTRACTOR IN POSSESSION OF SAID ENTITIES AND REFERENCES MAY BE MADE AVAILABLE TO THE OWNER.
- C. ONLY COMPLETE AND ACCURATE INFORMATION SHALL BE PROVIDED BY THE CONTRACTOR. THE CONTRACTOR HEREBY WARRANTS THAT, TO THE BEST OF ITS KNOWLEDGE AND BELIEF, THE RESPONSES

CONTAINED HEREIN ARE TRUE, ACCURATE, AND COMPLETE. THE CONTRACTOR ALSO ACKNOWLEDGES THAT THE OWNER IS RELYING ON THE TRUTH AND ACCURACY OF THE RESPONSES CONTAINED HEREIN. IF IT IS LATER DISCOVERED THAT ANY MATERIAL INFORMATION GIVEN IN RESPONSE TO A QUESTION WAS PROVIDED BY THE CONTRACTOR, KNOWING IT WAS FALSE, IT SHALL CONSTITUTE GROUNDS FOR IMMEDIATE TERMINATION OR RESCISSION BY THE OWNER OF ANY SUBSEQUENT AGREEMENT BETWEEN THE OWNER AND THE CONTRACTOR. THE OWNER SHALL ALSO HAVE AND RETAIN ANY OTHER REMEDIES PROVIDED BY LAW.

- D. IF THERE ARE ANY QUESTIONS CONCERNING THE COMPLETION OF THIS FORM, THE CONTRACTOR IS ENCOURAGED TO CONTACT THE PROJECT ARCHITECT,

- E. THE COMPLETED FORM SHALL BE SUBMITTED WITH THE CONTRACTOR'S PROPOSAL.
- F. THIS FORM, ITS COMPLETION BY THE CONTRACTOR, AND ITS USE BY THE CONTRACTOR, AND ITS USE BY THE OWNER, SHALL NOT GIVE RISE TO ANY LIABILITY ON THE PART OF THE OWNER TO THE CONTRACTOR OR ANY THIRD PARTY OR PERSON.

II. **GENERAL BACKGROUND**

- A. CURRENT NAME AND ADDRESS OF CONTRACTOR:

- B. PREVIOUS NAME OR ADDRESS OF CONTRACTOR, IF ANY:

C. CURRENT PRESIDENT
OR CHIEF EXECUTIVE
OFFICER: _____ Years
in that position _____

D. NUMBER OF EMPLOYEES:
(Permanent)

E. NAME AND ADDRESSES OF
CURRENT AFFILIATED
COMPANIES (PARENT,
SUBSIDIARY, DIVISIONS):

III. **FINANCIAL STATUS**

A. PLEASE ATTACH FINANCIAL STATEMENTS FOR THE
PAST THREE YEARS FOR WHICH THEY ARE COMPLETE.
IF SUCH STATEMENTS ARE NOT AVAILABLE, PLEASE
FURNISH THE FOLLOWING INFORMATION:

1. LAST COMPLETE FISCAL YEAR:

- a. Revenues (Gross) _____
- b. Expenditures (Gross) _____
- c. Overhead & Admin.
Cost (Gross) _____
- d. Profit (Gross) _____

2. YEAR PRIOR TO "1" ABOVE:

- a. Revenues (Gross) _____
- b. Expenditures (Gross) _____
- c. Overhead & Admin.
Cost (Gross) _____
- d. Profit (Gross) _____

3. YEAR PRIOR TO "2" ABOVE:

- a. Revenues (Gross) _____
- b. Expenditures (Gross) _____
- c. Overhead & Admin.
Cost (Gross) _____
- d. Profit (Gross) _____

B. BANKRUPTCIES

1. Has the Contractor, or any of its parents or subsidiaries, ever had a Bankruptcy Petition filed in its name, voluntarily or involuntarily? (If yes, specify date, circumstances, and resolution).

2. Has any Majority Shareholder ever had a Bankruptcy Petition filed in his/her name, voluntarily or involuntarily? (If yes, specify date, circumstances, and resolution).

C. LOANS

1. Is this Contractor currently in default on any loan agreement or financing agreement with any bank, financial institution or other entity? (If yes, specify details, circumstances, and prospects for resolution).

D. BONDING

1. What is the Contractor's current bonding capacity with a contract surety company?

2. Please identify the Contractor's surety company and the current line of bonding credit that company has extended to the Contractor.

3. Please give the name, address, and telephone number of your current surety agent or underwriting contact.

4. Have Performance or Payment Bond claims ever been made to a surety for Contractor on any project, past or present?

5. If the answer to (4) is yes, please describe the claim, the name of the company or person making the claim, and the resolution of the claim.

6. In the past five years, has any surety company refused to bond the Contractor on any project? (If answer is yes, specify the reasons given for such refusal, and the name and address of the surety company that refused to bond).

7. In the past five years, has any surety company refused to bond the Contractor's parent, or subsidiaries, on any project? (If answer is yes, please specify the reasons given for such refusal, and the name and address of the surety company that refused to bond).

E. MERGERS AND ACQUISITIONS

1. State whether or not the Contractor has been the subject of a corporate merger within the preceding three years. If so, please identify all parties to such merger, provide the date of same, and a brief description of the transaction.

2. State whether or not the Contractor has acquired any other companies or entities in the preceding three years. If so,

please identify all companies or entities acquired, provide the date of acquisition, and a brief description of the business of the company or entity acquired.

IV. **PROPOSED PROJECT PERSONNEL**

A. **PROPOSED PROJECT MANAGER**

1. List the name, qualifications and background of your proposed project manager for this Project. (Include the names and addresses of companies he/she has been affiliated with in the last five years).

2. List at least three projects, by size, type and duration, that the proposed project manager has supervised in the last five years for the Contractor, or for any other company.

B. **PROPOSED SUPERINTENDENT**

1. List the qualifications and background of your proposed job superintendent (if different than the project manager) and include the names and addresses of any companies he/she has been affiliated with in the last five years.

2. List at least three projects, by size, type, and duration, that the proposed job superintendent has supervised in the last five years for the Contractor, or for any other company.

V. **COMPANY EXPERIENCE - SIMILAR PROJECTS**

- A. List all projects of reasonably similar nature, scope, and duration (similar to the Owner's Project) performed by your company in the last seven years, specifying, where possible, the name and last known address of each owner of such projects.

- B. Of the projects listed in response to Subsection (A), identify any which was the subject of a substantial claim or lawsuit by, or against, the Contractor. Please identify in your response the nature of such claim or lawsuit, the court in which the case was filed, and the details of its resolution.

VI. **LEGAL PROCEEDINGS**

A. **ARBITRATIONS**

List all construction arbitration demands filed by, or against, the Contractor in the last five years, and identify the nature of the claim, the amount in dispute, the parties, and the ultimate resolution of the proceeding.

B. **LAWSUITS**

List all construction-related lawsuits (other than labor or personal injury litigation) filed by, or against, the Contractor in the last five years, and identify the nature of the claim, the amount in dispute, the parties, and the ultimate resolution of the lawsuit.

C. **OTHER PROCEEDINGS**

1. Identify any lawsuits, administrative proceedings, or hearings initiated by the National Labor Relations Board or similar state agency in the past seven years concerning any labor practices of the Contractor. Identify the nature of any proceeding and its ultimate resolution.

2. Identify any lawsuits, administrative proceedings, or hearings initiated by the Occupational Safety and Health Administration concerning the project safety practices of the Contractor in the last seven years. Identify the nature of any proceeding and its ultimate resolution.

3. Identify any lawsuits, administrative proceedings, or hearings initiated by the Internal Revenue Service, or any state revenue department, concerning the tax liability of the Contractor (other than audits) in the last seven years. Identify the nature of any proceeding and its ultimate resolution.

4. Have any criminal proceedings or investigations been brought against the Contractor in the last ten years? (If the answer is yes, please attach a complete and detailed report of the facts and circumstances concerning all such proceedings or investigations with your responses to this Questionnaire)

VII. **REFERENCES**

(ALL REFERENCES MUST BE CURRENT, I.E., ENTITIES WITH WHOM YOU HAVE DONE BUSINESS IN THE PRECEDING TWELVE MONTHS.)

A. BANKS

Bank #1

Name: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

Bank #2

Name: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

B. MAJOR SUBCONTRACTORS

Subcontractor #1

Name: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

Subcontractor #2

Name: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

C. SUPPLIERS

Major Supplier #1

Name: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

Major Supplier #2

Name: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

D. OWNERS

Project #1

Name: _____

Location: _____

Contract Price: _____

Owner: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

Arch/Eng: _____

Contact/Phone: _____

Project #2

Name: _____

Location: _____

Contract Price: _____

Owner: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

Arch/Eng: _____

Contact/Phone: _____

Project #3

Name: _____

Location: _____

Contract Price: _____

Owner: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

Arch/Eng: _____

Contact/Phone: _____

Project #4

Name: _____

Location: _____

Contract Price: _____

Owner: _____

City/State: _____

Contact: _____

Phone: _____

Arch/Eng: _____

Contact/Phone: _____

VIII. **COMMENTS**

Please list any additional information that you believe would assist the Owner in evaluating the possibility of using the Contractor on this Project. You may attach such additional information as an Exhibit to this Statement and Questionnaire.

I certify to the Owner that the information and responses provided on this Questionnaire are true, accurate and complete. The Owner, or its designated representative, may contact any

entity or reference listed in this Questionnaire. Each entity or reference may make any information concerning the Contractor available to the Owner or its designated representative.

Dated _____, 2017.

CONTRACTOR:

By: _____

Title: _____

Date: _____

Sworn to and subscribed
before me this _____ day of _____, 2017.

Notary Public

My Commission Expires _____

SECTION 00060 - REQUESTS FOR BEST AND FINAL OFFERS
(at Owner's Option)

Date :

Re: A NEW PRESS BOX FOR CARTERSVILLE HIGH SCHOOL

Dear Sir/Madam:

In conformity with the Request for Proposals issued by the Cartersville City School District, Board of Education ("the Board") in connection with the above-referenced Project, you are invited to submit in writing your best and final offer for construction of the Project. Any such best and final offer must provide for construction of the Project in accordance with all requirements of the Contract Documents. Any such offer must be received by the Board at its office located at _____ (telephone number _____) on or before _____ a.m., _____ day of _____, 2017. At your option you may send such offer by facsimile to the Board at facsimile number _____. **THE BOARD TAKES NO RESPONSIBILITY FOR THE ACTUAL OR TIMELY RECEIPT OF FACSIMILES.**

Any best and final offer submitted should set forth your proposed lump sum contract price as well as any applicable prices for unit price work and alternates as provided in the Contract Documents.

In the event the Board receives no further response from your firm, it will consider your Proposal as previously submitted to be your best and final offer. The Board continues to reserve the right to reject any and all Proposals and to waive any technicalities or informalities. All Proposals, and any response to this request for a best and final offer, are subject to all requirements of the Request for Proposals, the Instruction to Proposers, and all other requirements of the Contract Documents, and the Board expressly reserves any and all rights relating thereto.

Should you have any questions concerning this matter, please contact _____.

Very truly yours,

SECTION 00080 - PROPOSAL FORM

EXHIBIT "E"

THE CARTERSVILLE CITY SCHOOL DISTRICT, BOARD OF EDUCATION (the "Board"), pursuant to the provisions of O.C.G.A. § 36-91-1, *et. seq.*, herein seeks competitive proposals from general contractors for the construction of A New Visitor's Press Box for Cartersville High School located at 320 E. Church Street, Cartersville GA 30120 (the "Project"). This Proposal is submitted in response to the Board's Request for Proposals dated the 7th day of April, 2017.

This Proposal is for the full and complete construction of the Project in conformity with all requirements of the Contract Documents. The submission of this Proposal constitutes a representation by the Contractor that it has carefully studied and examined all of the Contract Documents dated 04/07/17 furnished by KRH Architects inc. (the "Architect") and such other information as may have been furnished by the Board or the Architect including Addendum/Addenda No._____. Contractor further represents that it has no knowledge of any ambiguities, errors, omissions or other inaccuracies in any of the Contract Documents or other material furnished by the Board or Architect in connection with the Project. Contractor submits herewith its duly executed affidavit in accordance with the applicable Federal work authorization program. Contractor acknowledges that upon execution of any contract with the Board, said affidavit shall be deemed a public record to the extent provided by Georgia law. Contractor acknowledges that the Contract Documents specifically provide for the assessment of liquidated damages against Contractor in the event of unexcused delay in achieving Substantial Completion or Final Completion of any phase of the work. The liquidated damages to be assessed in the event of unexcused delay in achieving Substantial Completion of Phase I are \$ 500.00 per calendar day. The liquidated damages to assessed in the event of unexecuted delay in achieving Final Completion of the Work are \$ 200.00 per calendar day. The terms and conditions of liquidated damages provisions set for in the Contract Documents are herein incorporated by reference. The Contractor further acknowledges that the Contract Documents provide no incentive provisions for early Completion of the Work.

A. Base Proposal

The Contractor proposes to fully and completely construct the Project in conformity with all requirements of the Contract Documents and furnish all necessary labor, material and equipment for such construction, and, furthermore, to fully, completely, and strictly perform all obligations of the Contractor as set forth in the Contract Documents, for the lump sum contract price of

(\$_____). Said lump sum contract price is allocated, in its entirety, to the following elements of the work:

General Conditions and Fees	\$ _____
Structural Steel	\$ _____
Roofing	\$ _____
Masonry	\$ _____
Other	\$ _____
Contingency Allowances	\$ <u>10,000.00</u>
TOTAL (must match lump sum)	\$ _____

B. Contingency Allowances:

1. <u>Contingency Allowance</u>	\$ 10,000.00
<u>TOTAL CONTINGENCY ALLOWANCES</u>	<u>\$ 10,000.00</u>

BE SURE TO TOTAL AND INCLUDE ALL ALLOWANCES IN YOUR LUMP SUM!

Allowances and unit prices shall be used for unforeseen conditions above and beyond the work included in the contract documents.

Attached hereto, and incorporated herein as part of this Proposal, Contractor submits a completed Contractor's Qualification Statement. Contractor acknowledges that the Board may rely upon the truthfulness and accuracy of the responses set forth therein.

In addition, Contractor has submitted herewith as part of this Proposal such documentation and information as Contractor deems appropriate to establish that it is a responsible and responsive Contractor and that its Proposal is the most advantageous to the Board, taking into consideration the specific evaluation factors, listed in their order of relative importance, as set forth in the above-referenced Request for Proposals. Contractor acknowledges that the Board may rely upon the truthfulness and accuracy of such documentation and information.

The Contractor proposes and agrees to commence actual construction (i.e, physical work) on site with adequate management, labor, materials and equipment within ten (10) days after receipt of Notice to Proceed and prosecute the Work diligently and faithfully to completion within the required Contract Time. Prior to commencing such Work, and prior to the issuance of the Notice to Proceed, Contractor shall furnish to the Board duly executed Payment and Performance Bonds complying with all requirements of the Contract Documents along with Certificates of Insurance demonstrating that all required coverages are in place.

Contractor submits herewith its executed Bid Bond in accordance with the requirements of the Board as set forth in the Instruction to Proposers.

Contractor herein acknowledges that this Proposal shall constitute an offer by Contractor to contract with the Board for construction of the Project in conformity with all requirements of the Contract Documents for the lump sum contract price as set forth hereinabove. Such offer also includes the proposed unit prices and proposed pricing for any Alternates. Said offer by Contractor is irrevocable and subject to acceptance by the Board until the expiration of sixty (60) days following the date set forth in the Request for Proposals for receipt of Proposals by the Board.

CONTRACTOR: _____

By: _____

Title: _____

Sworn and subscribed to before me this
_____ day of _____, 2017.

NOTARY PUBLIC

Commission Expiration:

SECTION 00090 – FORM OF AGREEMENT

- A. The contract will be AIA Document A-101-2007 with a lump sum fee, as the same may be amended or supplemented by the Owner.

INSURANCE

The Contractor shall not commence work until it has obtained all the insurance required in this Article, and such insurance has been approved by the Cartersville City School District (“CCSD/Owner”).

Policies and Coverage

The Contractor shall obtain and maintain for the term of the Contract the following policies and coverage:

- 1) Comprehensive or Commercial Form General Liability Insurance, on an occurrence basis, covering work done or to be done by or on behalf of the Contractor and providing insurance for bodily injury, personal injury, property damage, and contractual liability. The aggregate limit shall apply separately to the work.
- 2) Business Automobile Liability Insurance on an occurrence basis, covering owned, hired, and non-owned automobiles used by or on behalf of the Contractor and providing insurance for bodily injury, property damage, and contractual liability. Such insurance shall include coverage for uninsured and underinsured motorists.
- 3) Worker's Compensation including Employers Liability Insurance
- 4) Course of Construction Insurance covering all risk of loss, maintained at one hundred percent of the completed value based on the insurable portion of the work, including materials at the project site, stored off the project site, and in transit.
- 5) Any other insurance as required by law.

The Contractor shall obtain the following policies and coverage should the work involve hazardous materials:

- 1) Environmental Impairment Liability Insurance

Verification of Coverage

The Contractor shall submit certificates of insurance and separate letters of endorsements to the policies of insurance required by the contract to CCSD as evidence of the insurance coverage, naming CCSD’s officers, directors, employees, agents, volunteers and assigns as additional insured.

The scope of coverage and deductible shall be shown on the certificate of insurance. The certificates of insurance and endorsements shall provide for no cancellation or modification of coverage without thirty days written notice to CCSD. Renewal certifications and endorsements shall be timely filed by the Contractor for all coverage until the work is accepted as complete. CCSD reserves the right to require the Contractor to furnish complete, certified copies of all required insurance policies.

Waiver of Subrogation

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

Insurance Provisions

The insurance policies shall contain, or be endorsed to contain, the following provisions:

- 1) For the general and automobile liability policies, CCSD, its officers, employees, representatives, volunteers, and agents are to be covered as additional insureds.
- 2) For any claims related to the work, the Contractor's insurance coverage shall be primary insurance as respects to CCSD/Owner, its officers, employees, representatives, volunteers, and agents. Any insurance or self-insurance maintained by CCSD/Owner, its officers, employees, representatives, volunteers, and agents shall be in excess of the Contractor's insurance and shall not contribute with it.
- 3) Each insurance policy required by this Article shall state that coverage shall not be canceled by either the Contractor or the insurance carrier, except after thirty days prior written notice by certified mail, return receipt requested, has been given to CCSD/Owner.
- 4) CCSD, its officers, employees, representatives, volunteers, and agents shall not by reason of their inclusion as additional insureds incur liability to the insurance carriers for payment of premiums for such insurance.

- 5) Course of construction coverage shall contain the following provisions:
 - a. CCSD shall be named as loss payee; and
 - b. The insurer shall waive all rights of subrogation against CCSD/Owner.
 - c. If required in writing by a party in interest, the Contactor as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Contractor's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Contractor shall deposit in a separate account proceeds so received, which the contractor shall distribute in accordance with such agreement as the parties in interest may reach. If after such loss no other special agreement is made, replacement of damaged property shall be covered by appropriate Change Order.
- 6) Partial occupancy or use shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance.

Amount of Insurance

For all projects, other than those involving hazardous materials, the insurance furnished by the Contractor under this Article shall provide coverage in amounts not less than the following, unless a different amount is stated in the Supplementary General Conditions.

- 1) Comprehensive or Commercial form General Liability Insurance - Limits of Liability
 - a. \$2,000,000.00 General Aggregate
 - b. \$1,000,000.00 Each Occurrence - combined single limit for bodily injury and property damage.
- 2) Business Automobile Liability Insurance - Limits of Liability
 - a. \$1,000,000.00 Each Accident- combined single limit for bodily injury and property damage to include uninsured and underinsured motorist coverage.
- 3) Workers' Compensation limits as required by law with Employers Liability limits of \$1,000,000.00.
- 4) Course of Construction Insurance - 100% of the completed value of the work

For projects involving hazardous materials, only the Contractor and its hazardous materials subcontractor(s) shall provide coverage in amounts not less than the following, unless a different amount is stated in the Supplementary General Conditions:

- 1) Comprehensive or Commercial form General Liability Insurance - Limits of Liability
 - a. \$10,000,000.00 General Aggregate

- b. \$5,000,000.00 Each Occurrence - combined single limit for bodily injury and property damage.
- 2) Business Automobile Liability Insurance - Limits of Liability
 - a. \$1,000,000.00 Each Accident- combined single limit for bodily injury and property damage to include uninsured and underinsured motorist coverage.
- 3) Hazardous material transporter services must also have:
 - a. MCS-90 endorsement
 - b. Sudden & Accidental Pollution endorsement-Limits of Liability*
 - i. \$2,000,000.00 Each Occurrence
 - ii. \$2,000,000.00 General Aggregate

*A higher limit on the MCS-90 endorsement required by law must be matched by the Sudden & Accidental Pollution Insurance.

- 4) Workers' Compensation limits as required by law with employers Liability limits of \$1,000,000.00.
- 5) Course of Construction Insurance-100% of the completed value of the work
- 6) Environmental Impairment (pollution) Liability Insurance - Limits of Liability:
 - a. \$10,000,000.00 General Aggregate
 - b. \$5,000,000.00 Each Occurrence-combined single limit for bodily injury and property damage, including clean up costs.

Acceptability of Insurers

Insurers shall be licensed by the State of Georgia to transact insurance and shall hold a current A.M. Best's rating of A:VII; or shall be a carrier otherwise acceptable to CCSD.

Miscellaneous

- 1) Any deductible under any policy of insurance required in this Article shall be Contractor's liability.
- 2) Acceptance of certificates of insurance by CCSD/Owner shall not limit the Contractor's liability under the Contract.
- 3) If the General Liability coverage is provided by a Commercial General Liability Policy on a claims-made basis, the policy date or Retroactive Date shall predate the Contract; the termination date of the policy or applicable extended reporting period shall be no earlier than the termination date of coverage required to be maintained after the final payment, submit certification that policy is in effect at the time of final payment and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner.
- 4) In the event the Contractor does not comply with these insurance requirements, CCSD/Owner may, at its option, provide insurance coverage to protect CCSD/owner. The cost of the insurance shall be paid by the Contractor and, if prompt payment is not received, may be deducted from Contract sums otherwise due the Contractor.
- 5) If CCSD/Owner is damaged by the failure of the Contractor to provide or maintain the required insurance, the Contractor shall pay CCSD/Owner for all such damages.

A New Visitor's Press Box for for:
Cartersville High School

SECTION 00090
Form of Agreement

The Contractor's obligations to obtain and maintain all required insurance are not delegable duties under this Contract.

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS that [Name of Contractor] (hereinafter called the "**Principal**"), and [Name of Surety Company], (hereinafter called the "**Surety**"), are held and firmly bound unto THE CARTERSVILLE CITY SCHOOL DISTRICT, BOARD OF EDUCATION (hereinafter called the "**Obligee**"), for the use and benefit of any "Claimant" as hereinafter defined in the sum of _____ (\$ _____), lawful money of the United States of America, for the payment of which the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered, or is about to enter, into a certain written agreement with the Obligee, dated _____, (hereinafter the "**Agreement**"), for Construction of a project known as the New Visitor's Press Box for Cartersville High School located at 320 E. Church Street, Cartersville GA 30120 (the "Project").

NOW THEREFORE, the condition of this obligation is such, that if the Principal shall promptly make payment to any Claimant, as hereinafter defined, for all labor, services and materials used or reasonably required for use in the performance of the Agreement, then this obligation shall be void; otherwise to remain in full force and effect.

A "Claimant" shall be defined herein as any contractor, subcontractor, person, party, partnership, corporation or other entity furnishing labor, services, or materials used or reasonably required for use in the performance of the Agreement, or construction of the Project, without regard to whether such labor, services or materials were sold, leased or rented, and without regard to whether such Claimant is or is not in privity of contract with the Principal or any contractor or subcontractor performing work on the Project. Any entity entitled to protection of a payment bond under Georgia law shall be deemed a "Claimant" under this bond.

The surety is herein bound and obligated for all obligations of a surety as set forth in O.C.G.A. §§ 36-91-70 through and including O.C.G.A. § 36-91-75.

In the event of any claim made by a Claimant against the Obligee, or the filing of a lien against the property of the Obligee affected by the Agreement, the Surety shall either settle or resolve the claim, or remove any such lien by bond, or otherwise take such action as provided in the Agreement.

This bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this bond shall be deemed to be included herein as set forth at length. If any provision of this bond is held by a court competent jurisdiction to be in conflict with any applicable statute, then the provision of said statute shall govern and the remainder of this bond that is not in conflict therewith shall continue in full force and effect.

IN WITNESS WHEREOF, the Principal and Surety have hereunto affixed their corporate seals and caused this obligation to be signed by their duly authorized officers on this _____ day of _____, 2017.

[NAME OF PRINCIPAL]

BY: _____ [Seal]

Witness:

Date: _____

[NAME OF SURETY]

BY: _____ [Seal]

Witness:

Date: _____

Approved:

Date: _____

BY: _____

[ATTACH SURETY'S POWER OF ATTORNEY]

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS that
[Name of Contractor] (hereinafter called the “Principal”), and
[Name of Surety Company], (hereinafter called the “Surety”), are held and firmly bound
unto **THE CARTERSVILLE CITY SCHOOL DISTRICT, BOARD OF EDUCATION**
(hereinafter called the “Obligee”), for the use and benefit of any “Claimant” as hereinafter
defined in the sum of _____ (\$ _____), lawful money
of the United States of America, for the payment of which the Principal and the Surety
bind themselves, their heirs, executors, administrators, successors and assigns, jointly and
severally, firmly by these presents. WHEREAS, the Principal has entered, or is about to enter,
into a certain written agreement with the Obligee, dated _____, (hereinafter the
“Agreement”), for Construction of a project known as the New Visitor’s Press Box for
Cartersville High School located at 320 E. Church Street, Cartersville GA 30120 (the
“Project”).

NOW THEREFORE, the conditions of this obligation are as follows:

1.

That if the Principal shall fully and completely perform each and all of the terms,
provisions and requirements of the Agreement, including and during the period of any warranties
or guarantees required thereunder, and all modifications, amendments, changes, deletions,
additions, and alterations thereto that may hereafter be made; and if the Principal and the Surety
shall indemnify and hold harmless the Obligee from any and all losses, liability and damages,
claims, judgments, liens, costs and fees of every description, arising under the Agreement,
whether imposed by law or equity, which may be caused by failure or default on the part of the

Principal in the performance of any or all of the terms, provisions and requirements of the Agreement, including all modifications, amendments, changes, deletions, additions, and alterations thereto and any warranties or guarantees required thereunder, then this obligation shall be void; otherwise to remain in full force and effect.

2.

In the event of a failure of performance of the Agreement by the Principal, which shall include, but not be limited to, any breach or default of the Agreement, the Surety, upon demand by the Obligee, shall undertake and complete such required performance and cure any breach or default of the Agreement.

The Surety shall commence performance of its obligations and undertakings hereunder no later than forty-five (45) days after written notice from the Obligee to the Surety; and, if the Surety fails to commence performance as required herein within such period of time, or if the Surety otherwise breaches its obligations to the Obligee under this Bond and the Agreement, the Surety shall be liable to the Obligee for the Obligee's actual damages, including all costs of litigation and attorneys' fees, plus any penalties, as may be provided by law.

The means, methods or procedure by which the Surety undertakes to perform its obligations under this Bond shall be subject to the advance written approval of the Obligee, said approval not to be unreasonably withheld;

If the Surety fails or refuses to perform as provided above, or if the Obligee and the Surety cannot agree as to the means, methods or procedure of performance by the Surety, the Obligee shall have the right, through itself or others, to do all or any part of the remaining work yet to be performed by the Principal and the Surety shall pay Obligee any losses or damages resulting therefrom.

The Surety hereby waives notice of any and all modifications, omissions, additions, changes and advance payments or deferred payments in or about the Agreement, and agrees that the obligations undertaken by this Bond shall not be impaired in any manner by reason of any such modifications, omissions, additions, changes, and advance payments or deferred payments.

3.

Any suit under this bond must be instituted before the expiration of two (2) years from the date on which final payment under the Agreement falls due.

By Agreement, this Bond shall not be subject to the limitation period of O.C.G.A. § 36-91-52.

Should any term or condition of this Bond be held or determined unenforceable, all other terms and conditions shall remain in full force and effect.

IN WITNESS WHEREOF, the Principal and Surety have hereunto affixed their corporate seals and caused this obligation to be signed by their duly authorized officers or attorneys-in-fact, this _____ day of _____, 2017.

[NAME OF PRINCIPAL]

BY: _____ [Seal]

Witness:

Date:

[NAME OF SURETY]

BY: _____ [Seal]

Witness:

Date:

Approved:

Date: _____ BY: _____

[ATTACHED SURETY'S POWER OF ATTORNEY]

BID BOND

EXHIBIT "D"

KNOW ALL MEN BY THESE PRESENTS that

_____, as Surety (the "Surety"), and _____, as Principal (the "Contractor") are held and firmly bound unto THE CARTERSVILLE CITY SCHOOL DISTRICT, BOARD OF EDUCATION (the "Board"), pursuant to the terms and conditions of this Bond (the "Bid Bond") as set forth herein:

WHEREAS, the Contractor, in response to a Request for Proposals issued by the Board, has submitted its Proposal for the construction of a project known as the New Visitor's Press Box for Cartersville High School located at 320 E. Church Street, Cartersville GA 30120 (the "Project").

NOW, THEREFORE, the condition of this obligation is such that if the Board accepts the Proposal of the Contractor as submitted, or as revised or negotiated in accordance with the provisions of O.C.G.A. § 36-91-21(c)(2), and

- (a) The Contractor timely executes the Agreement between the Board and Contractor (the "Agreement") as provided by the Board and as included in the Contract Documents; and,
- (b) The Contractor furnishes to the Board fully executed Payment and Performance Bonds as required by the Agreement, then this obligation shall be void: otherwise, the Surety and the Contractor, shall be jointly and severally liable to the Board, and shall make payment to the Board, in the amount of five percent (5%) of the lump sum contract price (exclusive of any pricing for Alternates or unit prices) as set forth in the Proposal of the Contractor.

The Contractor agrees that the amount of this Bid Bond as set forth hereinabove constitutes a proper and lawful sum for liquidated damages which the Board will sustain in the event Contractor fails or refuses to execute the Agreement or fails or refuses to furnish the required Payment and Performance Bonds.

The Surety shall cause to be attached to this Bid Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of the Surety to execute and deliver same.

This Bid Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bid Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bid Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bid Bond that is not in conflict therewith shall continue in full force and effect.

IN WITNESS WHEREOF, the undersigned have caused this Bid Bond to be executed and their respective corporate seals to be affixed and attested by their duly authorized representatives this ____ day of _____, 2017.

[CONTRACTOR]

By: _____ [SEAL]

Witness

Sworn and subscribed to before me this
____ day of _____, 2017.

NOTARY PUBLIC
Commission Expiration:

[NAME OF SURETY]

By: _____ [SEAL]

Witness

Sworn and subscribed to before me this
____ day of _____, 2017.

NOTARY PUBLIC
Commission Expiration:

A New Visitor's Press Box for:
Cartersville High School

SECTION 00130
Bid Bond

[ATTACH PROPERLY EXECUTED POWER OF ATTORNEY]

SECTION 00150 – PRELIMINARY CONSTRUCTION SCHEDULE

A. Description: A Construction Schedule for the project is provided herein. This schedule includes specific dates shown in Items 1 through 14. Dates for Items 1 through 5 may be considered preliminary until such time as Item No. 5 “Contract Award” is made.

1. If all dates for Items 1 through 5 are maintained, then the dates for Items 6 through 14 become the fixed Construction Schedule.
2. If any dates of Items 1 through 5 slide forward, then all subsequent dates for Items 6 through 14 shall move forward by the same number of days that Item 5 misses its presently noted schedule.
3. The schedule dates for the project shall be strictly adhered to and are the last acceptable dates unless they are modified by mutual consent of the Owner and the Contractor by written change order. All dates shall be indicated on contractor’s construction schedule. All dates indicate midnight unless otherwise stipulated.

B. Schedule:

1. Advertisement of Request for Proposals.....04-10-2017
2. Preproposal Meeting & Time 2:00 PM.....04-25-2017
3. Proposal Due Date & Time.....05-08-2017
@10:00AM
4. Best & Final Offer (at Owner’s Option) Due Date & Time ..TBD
5. Award of Contract.....05-08-2017
6. Start of Contract Time05-08-2017
7. Pre-Construction Conference.....05-15-2017
@2:00PM
8. Receipt of Insurance05-15-2017
9. Notice to Proceed.....05-15-2017
10. Substantial Completion.....08-07-2017
11. Final Completion08-21-2018

End of Section

SECTION 01100 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Work covered by the Contract Documents.
 - 2. Type of contract.
 - 3. Proof of purchase for long-lead items.
 - 4. Owner-furnished products.
 - 5. Use of premises.
 - 6. Owner's occupancy requirements.
 - 7. Work restrictions.
 - 8. Specification formats and conventions.
 - 9. Miscellaneous provisions.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. The work includes material and labor necessary to complete all requirements described in both the drawings and specifications.

1.4 CONTRACT

- A. Project will be constructed under a general construction contract. See Section 00090.

1.5 PROOF OF PURCHASE FOR LONG-LEAD ITEMS

- A. Contractor shall submit to Owner proof of purchase of all mechanical units and any other long lead time items. This proof of purchase invoice shall be issued by the FACTORY and shall confirm that the order has been received from manufacturer's representative and shall be accompanied by copies of the mechanical units specifications, including make, size, voltage, model numbers, etc. and shall include anticipated shipping or delivery date. This submittal shall be issued to the General Contractor immediately after the Factory receives the Purchase Order from the Factory Representative so as not to delay the Work. Documents issued only by the Contractor as proof of purchase are not acceptable.

1.6 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated. The Contractor shall include as part of the Work all final plumbing, mechanical, and electrical connections.
 - 1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
 - 2. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule.
 - 3. After delivery, Owner will inspect delivered items for damage.
 - 4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.

5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties.
6. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
7. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
8. Owner is responsible for receiving, unloading, and handling Owner-furnished items at Project site. Contractor is responsible for making final plumbing, mechanical, and electrical connections.
9. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
10. If Owner-furnished items are damaged as a result of contractor's operations, Contractor shall repair or replace them.
11. Contractor shall install and otherwise incorporate Owner-furnished items into the Work.

B. Owner-Furnished Products: Indicated as NIC on drawings.

1.7 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 16-division format and CSI/CSC's "MasterFormat" numbering system.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred, as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
 - a. The words "shall", "shall be", or "shall comply with", depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01100

SECTION 02361 - TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following for termite control:
 - 1. Soil treatment.

1.3 DEFINITIONS

- A. EPA: Environmental Protection Agency.
- B. PCO: Pest control operator.

1.4 SUBMITTALS

- A. Product Data: Treatments and application instructions, including EPA-Registered Label.
- B. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following as applicable:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Brand name and manufacturer of termiticide.
 - 4. Quantity of undiluted termiticide used.
 - 5. Dilutions, methods, volumes, and rates of application used.
 - 6. Areas of application.
 - 7. Water source for application.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: A PCO who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and

has completed termite control treatment similar to that indicated for this Project and whose work has a record of successful in-service performance.

- B. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

1.7 COORDINATION

- A. Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

1.8 WARRANTY/CLOSEOUTS

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Three years from date of Substantial Completion.
- C. See Specification Section 01770 for additional requirements.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation. Use only soil treatment solutions that are not harmful to plants. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Manufacturers: Subject to compliance with requirements of the authority having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earthwork, slab and foundation work, landscaping, and other

conditions affecting performance of termite control. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.
- C. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction, for locations all locations, and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment evenly.
 - 1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 - 2. Foundations: Adjacent soil including soil along entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers, piers, and chimney bases; and along entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
 - 3. Crawlspace: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
 - 4. Masonry: Treat voids.
 - 5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.

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SECTION 02361
Termite Control

- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 02361

PART 1 GENERAL

1.1 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Foundation walls.
 - 3. Concrete toppings.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Samples: For waterstops and vapor retarder.
- E. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Waterstops.
 - 6. Curing compounds.
 - 7. Floor and slab treatments.
 - 8. Bonding agents.
 - 9. Adhesives.
 - 10. Semirigid joint filler.
 - 11. Joint-filler strips.
- F. Minutes of pre-installation conference.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

- B. **Manufacturer Qualifications:** A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

- C. **Testing Agency Qualifications:** An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

- D. **Source Limitations:** Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

- E. **ACI Publications:** Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5 and Section 7, "Lightweight Concrete".
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 - 3. ACI 318, "Building Code Requirements for Structural Concrete."

- F. **Concrete Testing Service:** Owner shall engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

- G. **Pre-installation Conference:** Conduct conference at Project site to comply with requirements in Division 1.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, shoring and re-shoring procedures, vapor-retarder installation, steel reinforcement installation, and concrete protection.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
 2. Precast concrete supports are acceptable for on-ground applications. For elevated slab areas, precast concrete supports are not permitted.
- B. Mechanical Terminators and Splices: Mechanical terminators and splices shall meet building code requirements. Terminators and splices shall be a positive locking, taper threading type anchor manufactured from high quality steel. The ends of reinforcing shall be tapered using the manufacturer's threading equipment to ensure proper taper and thread engagement. Reinforcing, terminators, and splices shall be installed pursuant to manufacturer's requirements.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
1. Portland Cement: ASTM C 150, Type I / II.
 - a. No other cementitious materials are permitted.
- B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded.
1. Maximum Coarse-Aggregate Size: 1 ½ inch nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Lightweight Aggregate: ASTM C 330, 3/4-inch nominal maximum aggregate size.
- D. Water: ASTM C 94 and potable.

2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494, Type A.
 2. Retarding Admixture: ASTM C 494, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

2.6 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.
- B. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch.

2.7 FLOOR AND SLAB TREATMENTS

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Colored, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315.
 - 1. To be used where concrete is indicated as the exposed floor finish.
 - 2. Products:
 - a. Euclid Chemical Company (The); Super Floor Coat Colored.
 - b. PROSOCO, Inc.; ColorSeal ChemMasters, Colored Polyseal.
 - c. TK Products; TK TRI-SEAL 1315 CCS.
 - d. Vexcon Chemicals, Inc.; Starseal 1315 Concrete Stain.
- F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
 - 1. Curing compound must be compatible with glue agent utilized for VCT.

2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
 - 1. All exterior expansion joint material shall be "zip strip" type with caulked joints.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.10 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. All Building Elements Except those Otherwise Noted: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 3000 psi at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.50.
 - 3. Slump Limit: 4 inches, plus or minus 1 inch.
 - 4. Air Content: 4 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
 - 5. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
- B. Concrete Toppings: Proportion structural lightweight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 3000 psi at 28 days.
 - 2. Calculated Equilibrium Unit Weight: 115 lb/cu. ft., plus or minus 3 lb/cu. ft. as determined by ASTM C 567.
 - 3. Slump Limit: 4 inches, plus or minus 1 inch.
 - 4. Air Content: 3 percent, plus or minus 1 percent at point of delivery for 3/4" nominal maximum aggregate size.
 - 5. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

2.12 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Chamfer exterior corners and edges of permanently exposed concrete.
- D. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

- A. Shoring of metal decking to control slab thickness, floor level and other tolerances, and concrete ponding is at the contractor's discretion.
- B. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

- C. Plan sequence of removal of shores and re-shore to avoid damage to concrete. Locate and provide adequate re-shoring to support construction without excessive stress or deflection.

3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement 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.
- F. Use of chairs or bolster is required for placement of welded wire fabric. Fabric laid on grade or bottom of form to be "pulled up" after concrete is in place will not be permitted.

3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 2. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction 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.

- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

3.7 WATERSTOPS

- A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- F. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces to receive a rubbed finish.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. 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.

3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in 1 direction.
 - 1. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 25; for slabs-on-grade.
 - 3. Measurements of F(F) and F(L) shall be made as soon as possible, preferably within 24 hours, but not later than 72 hours after placement of slabs-on-grade, and prior to removal of formwork and shoring for suspended slabs.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend

- with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
 - C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
 - D. All slab areas where epoxy floor systems are specified shall be flood tested prior to the installation of epoxy coating.

3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. 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.
- C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
 - 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 and Sealing Compound: Apply uniformly to floors and slabs indicated in a 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. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
 - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - 2. Do not apply to concrete that is less than 28 days' old.
 - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.14 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

3.15 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- C. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- D. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- E. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Steel reinforcement placement.
 2. Verification of use of required design mixture.
 3. Concrete placement, including conveying and depositing.
 4. Curing procedures and maintenance of curing temperature.
 5. Verification of concrete strength before removal of shores and forms from beams and slabs.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain at least one composite sample for each 50 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143; 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, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31.
 - a. Cast and laboratory cure four cylinder specimens for each composite sample.
 - b. Cast and laboratory cure two additional cylinder specimens as necessary for determining early strength for formwork or shoring considerations or for reserve usage.
7. Compressive-Strength Tests: ASTM C 39; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 03300

SECTION 04200 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 04732 - Calcium silicate manufactured building stone masonry. Section 04200 includes insulation, mortar, flashing, reinforcing and other accessories for calcium silicate manufactured building stone masonry.

1.2 SUMMARY

- A. Section Includes:
 - 1. Concrete masonry units.
 - 2. Building (common) brick.
 - 3. Mortar and grout.
 - 4. Embedded flashing.
 - 5. Cavity-wall insulation.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide **structural** unit masonry that develops indicated net-area compressive strengths at 28 days.
 - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
 - 2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection:

1. Brick.
2. Colored mortar.
3. Weep holes/vents.
4. Cavity wall insulation
5. Flashing and drainage system.

C. Material Certificates: For each type and size of the following:

1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
 - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include test report for efflorescence according to ASTM C 67.
 - d. For masonry units, include data and calculations establishing average net-area compressive strength of units.

D. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockup of typical wall area as shown on Drawings.
 2. Build mockups for each type of exposed unit masonry construction 72 inches long by 60 inches high by full thickness, including CMU, manufactured stone, brick, flashing, drainage material and accessories.
 - a. Include a full height sealant-filled joint in mockup.
 - b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
 - c. Include through-wall flashing installed along entire length of wall, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
 - d. Include veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
 3. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
 4. Protect accepted mockups from the elements with weather-resistant membrane.
 5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
 6. Approved mockups may not become part of the completed Work and shall remain until substantial completion.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
 - 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

2.3 MASONRY LINTELS

2.4 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units: Facing brick complying with ASTM C 216 as amended herein
 - 1. Size: Modular
 - 2. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 - 3. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 - 4. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 - 5. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
 - 6. Include in the Base Bid an allowance of \$1000.00 per 1000 bricks. This allowance is for the purchase of brick only. All other labor, accessories and materials shall be included in the work. The Contractor shall determine the quantity of bricks required to complete the work included in the Contract Documents and use this to determine the required allowance. Upon selection of the brick, any unused funds shall be refunded to the Owner based on a calculation of the difference in price per 1000 bricks and the quantities determined by the contractor in his Base Bid as indicated on the Proposal Form. The Contractor's quantities shall include all calculations for waste, cull and etc. needed to complete the work. No increase in quantities will be allowed after receipt of proposals.

2.5 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C 91.
- E. Mortar Cement: ASTM C 1329.
- F. Colored Cement Product: Packaged blend made from masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - 1. Colored Masonry Cement:
 - a. Products:
 - 1) Mortamix Color Masonry Cement.
 - 2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.
 - 3) Lafarge North America Inc.; U.S. Cement Custom Color Masonry Cement.
 - 4) Argos Custom Color Masonry Cement.
 - 5) National Cement Company, Inc.; Coosa Masonry Cement.
- G. Water: Potable.

2.6 REINFORCEMENT

- A. Masonry Joint Reinforcement, General: See the Structural documents for additional masonry reinforcement.

2.7 EMBEDDED FLASHING MATERIALS

- A. Flexible Flashing:
 - 1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch.
 - a. Products:
 - 1) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
 - 2) Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier Thru-Wall Flashing.
 - 3) Grace Construction Products, W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
 - 4) W. R. Meadows, Inc.; Air-Shield Thru-Wall Flashing.
 - b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

- B. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt (No. 30 asphalt felt).
- D. Weep/Vent Products: Use the following unless otherwise indicated:
 - 1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth **1/8 inch** less than depth of outer wythe, in color selected from manufacturer's standard.
 - a. Products:
 - 1) Advanced Building Products Inc.; Mortar Maze weep vent.
 - 2) Blok-Lok Limited; Cell-Vent.
 - 3) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
 - 4) Heckmann Building Products Inc.; No. 85 Cell Vent.
 - 5) Hohmann & Barnard, Inc.; Quadro-Vent.
 - 6) Wire-Bond; Cell Vent.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - 1. Provide one of the following configurations:
 - a. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.
 - 1) Basis-of-Design Product: Subject to compliance with requirements, provide Keene Building Products; KeeneStone Cut or comparable product by one of the following:
 - a) Mortar Net USA, Ltd.

2.9 CAVITY-WALL INSULATION

- A. Extruded-Polystyrene Board Insulation with Increased R-Value: ASTM C 578, Type IV, 1.5" thick, closed-cell product with an integral skin.
- B. Adhesive: Type recommended by insulation board manufacturer for application indicated.

2.10 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
1. Manufacturers:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.11 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
 2. Limit cementitious materials in mortar to Portland cement and lime.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry. Substitutions must be approved prior to use.
1. For masonry below grade or in contact with earth, use Type M.
 2. For reinforced masonry, use Type S.
 3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type M or Type S. For brick use type N.
- D. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required.
1. Pigments shall not exceed 10 percent of portland cement by weight.
 2. Mix to match Architect's sample.
 3. Application: Use pigmented mortar for exposed mortar joints with the following units:
 - a. Split-faced CMUs.
 - b. Concrete facing brick.
 - c. Face brick.
- E. Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type indicated on structural documents.

2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of **8 to 11 inches** as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Cull oddly colored or textured units. Absolutely no staining of masonry will be allowed.
 1. Mix units from several pallets or cubes as they are placed.
- F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For location of elements in plan do not vary from that indicated by more than plus or minus 1/4 inch.
2. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels: Comply with ACI 530.1/ASCE 6/TMS 602 and with the following.

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/8 inch in 10 feet, or 1/4 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet or 1/2 inch (12 mm) maximum.
3. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet or 1/2 inch maximum.
4. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2 inch maximum.
5. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch .
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/16 inch .
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/16 inch.]
4. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

D. Cracks and Chips. This requirement shall apply to all masonry construction

1. For the allowable percentage of exposed brick and block allowed in the wall, chips shall be limited to that size able to be completely covered by a \$.10 U.S. Dime in CMU and limited to 1/4" by 1/4" square in all brick. No other chips are allowed
2. For the allowable percentage of exposed brick and block allowed in the wall, surface cracks shall be limited to 1.5" in length and no wider than 1/16" in CMU and 1/2" in length and no wider than 1/16" in brick. Any cracks extending through the brick or block shall not be acceptable. No other cracks are allowed

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Masonry: Unless otherwise indicated, lay exposed concrete masonry in, **running bond, lay exposed brick masonry in one-third running bond.** Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar.
- F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, in the joint below and rod mortar or grout into core.
- G. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- H. Build non-load-bearing interior partitions to heights indicated on drawings.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Fasten partition top anchors to structure above as required by structural documents.
 - 3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with referenced UL design assembly.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick and CMUs as follows:
 - 1. With face shells fully bedded in mortar and with head joints fully bedded.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
 - 1. Do not wet CMU's before laying.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated. Do not leave finger joints.
 - 1. Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not shown, lay walls with 3/8" joints.

3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together.
 - a. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
- B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- C. Dampproofing: Apply asphalt emulsion dampproofing to exterior side of C.M.U. surfaces as recommended by manufacturer. Product shall be equal to Hydrocide 600 by Sonneborn. Products of equal quality will be acceptable with prior approval. Remove all excess mortar from block face and from reinforcement prior to application of dampproofing.
- D. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
 - 1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.7 MASONRY JOINT REINFORCEMENT

- A. General: Install as indicated on structural documents.

3.8 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
 - 1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally with not less than 1 anchor for each 2 of wall area. .

3.9 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to wall framing with 2- piece (hook and eye) masonry-veneer anchors to comply with the following requirements.

1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 2. Embed tie sections in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches (o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 8 inches, around perimeter.
- B. Anchor masonry veneers to masonry backup with 2- piece (hook and eye) masonry-veneer anchors to comply with the following requirements:
1. Embed tie sections in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
 2. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 3. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches around perimeter.
 4. Care shall be taken not to bend or otherwise deform any component of the masonry anchors.

3.10 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
1. Install preformed control-joint gaskets designed to fit standard sash block.
- C. Form expansion joints in brick as follows:
1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches (100 mm) in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
 2. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod.
- D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.
1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.11 LINTELS

- A. Install steel lintels where indicated.
- B. Provide masonry lintels where shown
- C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.12 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, door & window openings, other openings, other obstructions to downward flow of water in wall, and where indicated. Install vents at all areas to receive flashing.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of **6 inches above cavity drainage material**, and through inner wythe to within 1/2 inch of the interior face of wall in exposed masonry.
 - 3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 6 inches above cavity drainage material with upper edge firmly secured to sheathing. Ensure that moisture barrier completely covers the joint between the flashing and sheathing.
 - 4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 - 5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
 - 1. Use specified weep/vent products to form weep holes.
 - 2. Space weep holes 24 inches o.c. unless otherwise indicated.
- E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material.

3.13 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms 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 loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than 60 inches.

3.14 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

3.15 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, 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 joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.

3. Protect adjacent nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

3.16 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF SECTION 04200

PART I GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Structural steel.

1.2 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges (2010)", that support design loads.

1.3 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand ASD-service loads indicated and comply with other information and restrictions indicated.
 - 1. Select and complete connections using schematic details and procedures indicated in AISC's "Steel Construction Manual," Parts 9 through 15.
 - a. Details shown on the drawings are typical, similar details apply to similar conditions unless otherwise indicated.
 - b. Connections shown on the structural drawings are schematic and are only intended to show the relationship of members connected. Connection details indicated on the drawings shall be incorporated into Fabricator's connection design.
 - 2. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.
 - 3. Connections for a beam which cannot conform to AISC typical connection details shall be designed and detailed in accordance with the following.
 - a. Where beam reactions are not shown on the drawings, connections shall be designed for one-half the maximum uniform load which the beam will support (as simple span) for the span shown on the drawings for non-composite beams or three-quarters of the maximum uniform load which the beam will support (as simple span) for the span shown on the drawings for composite beams.
 - b. Where connections support beams which are subject to concentrated loads, such concentrated loads shall be taken into account when designing the connections.
 - c. Where connections are subject to eccentricity, such eccentricity shall be taken into account when designing the connections.
 - d. End connections of floor members shall accommodate end rotations of simple, unrestrained beams. For this purpose, inelastic action in the connection is permitted.
 - e. Coped or cut ends of members shall be reinforced where required to sustain the specified reactions.

- B. Design Responsibility: The Fabricator shall be responsible for all errors of detailing on the shop drawings, errors in fabrication, and for the correct fitting of the structural steel members.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
 - 5. For structural-steel connections indicated to comply with design loads, include structural analysis data prepared by the qualified professional engineer responsible for their preparation.
- C. Welding certificates.
- D. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
 - 1. Structural steel including chemical and physical properties.
 - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 3. Shear stud connectors.
 - 4. Shop primers.
 - 5. Nonshrink grout.
- E. Source quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer with not less than 5 years' experience in the erection of structural steel 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, and who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU.
- C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- D. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC's "Code of Standard Practice for Steel Buildings and Bridges (AISC 303-10)".
 - a. Paragraph 4.4.1 (b) of the above Code is hereby modified by the revision: "Confirmation that the Owner's Designated Representative for Design has

reviewed the Connection details shown on the Shop and Erection Drawings and submitted in accordance with Section 3.1.2, if applicable; and,"

- b. Paragraph 4.4 of the above is hereby modified by the revision: "These drawings shall be returned to the Fabricator within 23 calendar days."

- 2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
- 3. AISC's Specification for Structural Steel Buildings—AISC 14th edition (2010).
- 4. AISC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts (2009)."

- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. 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, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.7 COORDINATION

- A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992.
- B. Channels, Angles, M, S-Shapes: ASTM A 36.
- C. Plate and Bar: ASTM A 36.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- E. Steel Pipe: ASTM A 53, Type E or S, Grade B.
- F. Welding Electrodes: Comply with AWS requirements.

2.2 **BOLTS, CONNECTORS, AND ANCHORS**

- A. High-Strength Bolts, Nuts, and Washers: 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: Plain
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325 compressible-washer type.
 - a. Finish: Plain
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 490, compressible-washer type, plain.
- C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy hex head steel structural bolts with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Plain.
- D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
- E. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
 - 1. Nuts: ASTM A 563 heavy hex carbon steel.
 - 2. Plate Washers: ASTM A 36 carbon steel.
 - 3. Washers: ASTM F 436 hardened carbon steel.
 - 4. Finish: Plain.
- F. Threaded Rods: ASTM A 36
 - 1. Nuts: ASTM A 563 heavy hex carbon steel.
 - 2. Washers: ASTM F 436 hardened ASTM A 36 carbon steel.
 - 3. Finish: Plain
- G. Clevises and Turnbuckles: ASTM A 108, Grade 1035, cold-finished carbon steel.
- H. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.

2.3 **PRIMER:**

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.
- B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.4 GROUT:

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's Specification for Structural Steel Buildings—AISC 14th edition (2010).
 - 1. Camber structural-steel members where indicated.
 - 2. Identify high-strength structural steel according to ASTM A6 and maintain markings until structural steel has been erected.
 - 3. Mark and match-mark materials for field assembly.
 - 4. Delete below if shop priming is not required.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shop priming operations.
- B. Architecturally Exposed Structural Steel: Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel identified as architecturally exposed structural steel.
 - 1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.
 - 2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
- C. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning".
- D. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened unless otherwise indicated on the drawings or where pretensioned or slip-critical joints are recommended or required by RCSC or AISC.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. For architecturally exposed structural steel, remove backing bars or runoff tabs, back gouge, and grind steel smooth.
2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.7 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. Surfaces to receive sprayed fire-resistive materials.
 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 1. SSPC-SP 2, "Hand Tool Cleaning."
 2. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at 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.
- D. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.8 SOURCE QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of concrete and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

3.2 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.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings.
- B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
- C. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- E. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.
- G. No burning or welding of steel shall be performed unless shown on the drawings and specifications or directed by the Structural Engineer of Record. Any burning performed to elongate hole openings or to otherwise facilitate erection shall not be permitted and all affected steel members shall be removed and replaced.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened unless otherwise indicated on the drawings or where pretensioned or slip-critical joints are recommended or required by RCSC or AISC.

- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings—AISC 14th edition (2010) for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 - 2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.
 - 3. Contractor shall clean and prime all joints and bolts within 72 hours of installation.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
 - 1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding.
- E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- F. Contractor shall not request engineer approval or acceptance of any determined deficiency with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 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 and accessories and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 05120

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. K-series steel joists.
 - 2. KCS-type K-series steel joists.
 - 3. K-series steel joist substitutes.
 - 4. Joist accessories.

1.2 DEFINITIONS

- A. SJI "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
- B. Special Joists: Steel joists requiring modification by manufacturer to support non-uniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications." Steel joists with a slope in excess of $\frac{1}{4}$ inch per 12 inches requiring special joist seat considerations.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
- B. Design special joists to withstand design loads with live load deflections no greater than the following:
 - 1. Roof Joists: Vertical deflection of 1/360 of the span.

1.4 SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product indicated.
- B. Shop Drawings: Show layout, designation, number, type, location, and spacing of joists. Include joining and anchorage details, bracing, bridging, joist accessories; splice and connection locations and details; and attachments to other construction.
 - 1. Indicate locations and details of bearing plates to be embedded in other construction.
 - 2. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.
- C. Welding certificates.
- D. Manufacturer Certificates: Signed by manufacturers certifying that joists comply with requirements.
- E. Mill Certificates: Signed by bolt manufacturers certifying that bolts comply with requirements.

- F. Field quality-control test and inspection reports.

1.5 **QUALITY ASSURANCE**

- A. **Manufacturer Qualifications:** A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications."
- 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."

1.6 **DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.7 **SEQUENCING**

- A. Deliver steel bearing plates to be built into masonry construction.

PART 2 - PRODUCTS

2.1 **MATERIALS**

- A. **Steel:** Comply with SJI's "Specifications" for web and steel-angle chord members.
- B. **Steel Bearing Plates:** ASTM A 36.
- C. **Carbon-Steel Bolts and Threaded Fasteners:** ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
 - 1. **Finish:** Plain, uncoated.
- D. **High-Strength Bolts, Nuts, and Washers:** 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:** Plain.
- E. **Welding Electrodes:** Comply with AWS standards.

2.2 **PRIMERS**

- A. **Primer:** SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.3 K-SERIES STEEL JOISTS

- A. Manufacture steel joists of type indicated 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.
 - 1. Joist Type: K-series steel joists and KCS-type K-series steel joists.
- B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
- C. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.
- 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. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.4 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 for stability.
- B. Fabricate steel bearing plates with integral anchorages of sizes and thicknesses indicated.
- C. Supply ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface, unless otherwise indicated.
- D. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.5 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2.
- B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.
- C. Apply 1 coat of shop 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

3.1 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured, or only after unsatisfactory conditions have been corrected.
- 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 in 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 erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 - 4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.
- C. Field weld joists to supporting steel bearing plates and framework. 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 carbon-steel bolts.
- E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.
- F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.
- G. No burning or welding of steel shall be performed unless shown on the drawings and specifications or directed by the Structural Engineer of Record. Any burning performed to elongate hole openings or to otherwise facilitate erection shall not be permitted and all affected steel members shall be removed and replaced.
- H. Contractor shall clean and prime all joints and bolts within 72 hours of installation.

3.2 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and 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.
- C. Bolted connections will be visually inspected.
- D. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."

- E. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.
- F. Additional testing will be performed to determine compliance of corrected Work with specified requirements.
- G. Alterations to joist and joists accessories shall be per manufacturer's direction and shall be subject to architect approval.
- H. Contractor shall not request engineer approval or acceptance of any determined deficiency with the Contract Documents.

END OF SECTION 05210

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Roof deck.
 - 2. Noncomposite floor deck.

1.2 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.
- C. Product Certificates.
- D. Welding certificates.
- E. Field quality-control test and inspection reports.

1.3 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- B. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- C. FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.4 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.

1.5 COORDINATION

- A. Coordinate installation of sound-absorbing insulation strips in topside ribs of acoustical deck with roofing installation to ensure protection of insulation strips against damage from effects of weather and other causes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Canam Steel Corp.; The Canam Manac Group.
 2. Consolidated Systems, Inc.
 3. Nucor Corp.; Vulcraft Division.
 4. Roof Deck, Inc.
 5. United Steel Deck, Inc.
 6. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

2.2 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 with the following:
1. Prime-Painted Steel Sheet: ASTM A 1008, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
 2. Deck Profile: As indicated.
 3. Profile Depth: As indicated.
 4. Design Uncoated-Steel Thickness: As indicated.
 5. Span Condition: Triple span or more.
 6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 NONCOMPOSITE FLOOR DECK

- A. Noncomposite Steel Floor Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 30 with the minimum section properties indicated, and with the following:
1. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33 G60 zinc coating.
 2. Profile Depth: As indicated on drawings.
 3. Design Uncoated-Steel Thickness: As Indicated on drawings.
 4. Span Condition: Triple span or more.
 5. Side Laps: Overlapped

2.4 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-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. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. 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.
- 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. Rolled-in Hanger Tabs: Provide for use with floor deck as indicated on plans.
- I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.
- J. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

PART 3 - EXECUTION

3.1 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 in this Section, and as indicated on the structural contract documents.
- B. Locate deck 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 frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.2 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
 - 1. Weld Diameter: 5/8 inch, nominal.
 - 2. Weld Spacing: as indicated.
- B. Side-Lap and Perimeter Edge Fastening: As indicated on drawings, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum or butted at Contractor's option.
- D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.
- E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.
- F. Sound-Absorbing Insulation: Installation into topside ribs of deck as specified in Division 7.

3.3 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: 5/8 inch, nominal.
 - 2. Weld Spacing: Space and locate welds as indicated.
- B. Side-Lap and Perimeter Edge Fastening: As indicated on drawings, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Butted.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 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. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05310

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Exterior non-load-bearing wall framing.

1.2 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. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height.
 - 3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, 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 1/2 inch, or primary building framing element span divided by 240 (whichever is greater).
- B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
 - 1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
 - 2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
 - 3. Roof Trusses: Design according to AISI's "Standard for Cold-Formed Steel Framing - Truss Design."

1.3 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, splices, accessories, connection details, and attachment to adjoining work.

- C. Welding certificates.
- D. Qualification Data
- E. Product Test Reports

1.4 **QUALITY ASSURANCE**

- A. **Installer Qualifications:** Engage an experienced installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this project and whose work has resulted in construction with a record successful in service performance.
- B. **Engineering Responsibility:** Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- C. **Professional Engineer Qualifications:** A professional engineer who is legally qualified to practice in jurisdiction where Project is located 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.
- D. **Product Tests:** Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements.
- E. **Welding:** Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- F. **Fire-Test-Response Characteristics:** Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- G. **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. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

1.5 **DELIVERY, STORAGE, AND HANDLING**

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 **MATERIALS**

- A. **Steel Sheet:** ASTM A 1003, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance
2. Coating: G90 or equivalent

2.2 EXTERIOR NON-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: 0.0329 inch.
 2. Minimum Flange Width: 1-5/8 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: Matching steel studs.
- C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
 1. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure.
- D. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.3 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003, 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, as follows:
 1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Anchor clips.
 5. End clips.
 6. Foundation clips.
 7. Gusset plates.
 8. Stud kickers, knee braces, and girts.
 9. Joist hangers and end closures.
 10. Hole reinforcing plates.
 11. Backer plates.

2.4 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123.
- B. Anchor Rods: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- D. Power-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 design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.5 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. 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, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- E. 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.

2.6 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, 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 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 three exposed screw threads.
 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- 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. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 **INSTALLATION, GENERAL**

- A. 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.
- B. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
- C. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- D. 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.
- E. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- F. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- G. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- H. 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 (1:960) and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 **EXTERIOR NON-LOAD-BEARING WALL INSTALLATION**

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: 24 inches maximum.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single-leg deflection tracks and anchor to building structure.
 - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 - 3. Connect vertical deflection clips to bypassing or infill studs and anchor to building structure.

4. Connect drift clips to cold formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - a. Install solid blocking at centers indicated on Shop Drawings.
 2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05400

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Steel framing and supports for ceiling-hung toilet compartments.
2. Steel framing and supports for countertops.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Elevator machine beams, hoist beams, and divider beams.
6. Support angles for elevator door sills.
7. Shelf angles.
8. Loose bearing and leveling plates.
9. Steel weld plates and angles for casting into concrete not specified in other Sections.
10. Structural-steel door frames.
11. Miscellaneous steel trim including steel angle corner guards and steel edgings.
12. Metal bollards.
13. Pipe guards.
14. Abrasive metal nosing treads and thresholds.

- B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.3 SUBMITTALS

- A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Metal nosings and treads.
3. Paint products.
4. Grout.

- B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- C. Samples for Verification: For each type and finish of extruded nosing and tread.
- D. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- E. Welding certificates.
- F. Qualification Data: For professional engineer.

1.4 **QUALITY ASSURANCE**

- A. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
 - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
 - 4. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.5 **PROJECT CONDITIONS**

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Provide allowance for trimming and fitting at site.

1.6 **COORDINATION**

- A. Coordinate installation of anchorages for metal fabrications. 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.
- B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 **MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.

3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 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.

2.3 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36.
- B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
- C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- D. Rolled-Steel Floor Plate: ASTM A 786, rolled from plate complying with ASTM A 36 or ASTM A 283, Grade C or D.
- E. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- F. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface.
 1. Available Products:
 - a. IKG Industries, a Harsco company; Mebac.
 - b. W. S. Molnar Company; SlipNOT.
- G. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- H. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- I. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3.
 1. Size of Channels: As indicated.
 2. Material: Galvanized steel complying with ASTM A 653, structural steel, Grade 33, with G90 coating; nominal thickness.
- J. Cast Iron: ASTM A 48, Class 30, unless another class is indicated or required by structural loads.

2.4 NONFERROUS METALS

- A. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- B. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.

- C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632, Alloy 6061-T6.
- D. Aluminum Castings: ASTM B 26, Alloy 443.0-F.
- E. Bronze Plate, Sheet, Strip, and Bars: ASTM B 36, Alloy UNS No. C28000 (muntz metal, 60 percent copper).
- F. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).
- G. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).
- H. Nickel Silver Extrusions: ASTM B 151, Alloy UNS No. C74500.
- I. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.5 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for 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. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.
- D. Anchor Rods: ASTM F 1554, Grade 36.
 - 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- E. Eyebolts: ASTM A 489.
- F. Machine Screws: ASME B18.6.3.
- G. Lag Bolts: ASME B18.2.1.
- H. Wood Screws: Flat head, ASME B18.6.1.
- I. Plain Washers: Round, ASME B18.22.1.
- J. Lock Washers: Helical, spring type, ASME B18.21.1.

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

- B. Shop Primers: Provide primers that comply with Division 09 painting Sections.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- 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. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- F. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.7 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 bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. 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 no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. 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.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
- C. Galvanize miscellaneous framing and supports where exposed to the exterior or otherwise indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer where not galvanized.

2.9 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

2.10 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
 1. Provide mitered and welded units at corners.
 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.
- D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.11 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Prime plates with zinc-rich primer.

2.12 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.13 STRUCTURAL-STEEL DOOR FRAMES

- A. Fabricate structural-steel door frames from steel shapes, plates, and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch steel channel stops, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than 10 inches o.c. Reinforce frames and drill and tap as necessary to accept finish hardware.
 - 1. Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.
- B. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.
- C. Prime exterior steel frames and interior steel frames, where indicated with zinc-rich primer.

2.14 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Prime exterior miscellaneous steel trim and interior miscellaneous steel trim, where indicated with zinc-rich primer.

2.15 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.
 - 1. Cap bollards with 1/4-inch- thick steel plate.

2. Where bollards are indicated to receive push-button controls for door operators, provide necessary cutouts for push-button controls and hole for wire.
- B. Fabricate bollards with 3/8-inch- thick steel base plates for bolting to concrete slab. Drill base plates at all 4 corners for 3/4-inch anchor bolts.
1. Where bollards are to be anchored to sloping concrete slabs, angle base plates for plumb alignment of bollards.
- C. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.

2.16 ABRASIVE METAL NOSINGS TREADS AND THRESHOLDS

- A. Cast-Metal Units: Cast gray iron, Class 20, with an integral abrasive finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.
1. Manufacturers:
 - a. American Safety Tread Co., Inc.
 - b. Balco Inc.
 - c. Barry Pattern & Foundry Co., Inc.
 - d. Granite State Casting Co.
 - e. Safe-T-Metal Co.
 - f. Wooster Products Inc.
 2. Nosings: Cross-hatched units, 4 inches wide with 1-inch lip, for casting into concrete steps.
 3. Nosings: Cross-hatched units, 1-1/2 by 1-1/2 inches, for casting into concrete curbs.
 4. Treads: Cross-hatched units, full depth of tread with 3/4-by-3/4-inch nosing, for application over bent plate treads or existing stairs.
 5. Thresholds: Fluted-saddle-type units, 5 inches wide by 1/2 inch high, with tapered edges.
 6. Thresholds: Fluted-interlocking- (hook-strip-) type units, 5 inches wide by 5/8 inch high, with tapered edge.
 7. Thresholds: Plain-stepped- (stop-) type units, 5 inches wide by 1/2 inch high, with 1/2-inch step.

2.17 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.

2.18 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123, for galvanizing steel and iron products.
 2. ASTM A 153, for galvanizing steel and iron hardware.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
- C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

2.19 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. Bright, Directional Satin Finish: No. 4.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing 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 surfaces of exterior units that have been hot-dip galvanized after fabrication and are 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 no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.
- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
 - 1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING PREFABRICATED BUILDING COLUMNS

- A. Install prefabricated building columns to comply with AISC's "Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design with Commentary" and with requirements applicable to listing and labeling for fire-resistance rating indicated.

3.4 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 INSTALLING METAL BOLLARDS

- A. Anchor bollards to existing construction with expansion anchors. Provide four 3/4-inch bolts at each bollard, unless otherwise indicated.

1. Embed anchor bolts at least 4 inches in concrete.
- B. Fill bollards solidly with concrete, mounding top surface to shed water.
 1. Do not fill removable bollards with concrete.

3.6 **INSTALLING NOSINGS, TREADS, AND THRESHOLDS**

- A. Center nosings on tread widths.
- B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.
- C. Seal thresholds exposed to exterior with elastomeric sealant complying with Division 07 Section "Joint Sealants" to provide a watertight installation.

3.7 **ADJUSTING AND CLEANING**

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the 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.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

SECTION 06100 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Rooftop equipment bases and support curbs.
 - 2. Wood furring, grounds, nailers, and blocking.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:
 - 1. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
 - 2. 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-holding capacities of treated materials.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.
 - 1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Wood-Preservative-Treated Materials:
 - a. Baxter: J. H. Baxter Co.
 - b. Chemical Specialties, Inc.
 - c. Continental Wood Preservers, Inc.
 - d. Hickson Corp.
 - e. Hoover Treated Wood Products, Inc.
 - f. Osmose Wood Preserving, Inc.

2.2 LUMBER, GENERAL

- A. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.
 - 1. NELMA - Northeastern Lumber Manufacturers Association.
 - 2. SPIB - Southern Pine Inspection Bureau.
 - 3. WWPA - Western Wood Products Association.
- B. 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.
- C. 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 sizes for dry lumber.
 - 1. Provide lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. General: Where lumber or plywood is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWPA C2 (lumber) and AWPA C9 (plywood). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.
 - 1. For exposed items indicated to receive stained finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- B. Pressure treat aboveground items with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. (4.0 kg/cu. m). After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat indicated items and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing members less than 18 inches (460 mm) above grade.
 - 4. Wood floor plates installed over concrete slabs directly in contact with earth.
- C. Complete fabrication of treated items before treatment, where possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

2.4 DIMENSION LUMBER

- A. General: Provide dimension lumber of grades indicated according to the ALSC National Grading Rule (NGR) provisions of the inspection agency indicated.
- B. Non-Load-Bearing Interior Partitions: Provide framing of the following grade and species:
 - 1. Grade: Standard, Stud, or No. 3.
 - 2. Species: Southern pine; SPIB.
- C. Framing Other than Non-Load-Bearing Partitions: Provide framing of the following grade and species:
 - 1. Grade: No. 2.
 - 2. Species: Southern pine; SPIB.

2.5 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other construction, and support bases, cant strips, bucks, 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 No. 3 or Standard grade lumber per ALSC's NGRs of any species. For board-size lumber, provide No. 3 Common grade per NELMA, NLGA, or WWPA; No. 2 grade per SPIB; or Standard grade per NLGA, WCLIB or WWPA of any species.

2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of Type 304 stainless steel.
- B. Nails, Wire, Brads, and Staples: FS FF-N-105.
- C. Power-Driven Fasteners: CABO NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M)
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.
- C. Fit rough 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 and plywood.
- E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with Georgia State minimum building codes.

- F. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.
- G. Use hot-dip galvanized or stainless-steel nails where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity.
- H. Countersink nail heads on exposed carpentry work and fill holes with wood filler.

3.2 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

- A. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attaching other work. Form to shapes shown and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

3.3 WOOD FURRING

- A. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

END OF SECTION 06100

SECTION 07210 - BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Concealed building insulation.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Wall insulation – See also Section 04200 – Unit Masonry
 - 2. Section 07220
 - 3. Section 07221
 - 4. Section 04200 for additional requirements

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each type of insulation product specified.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products complying with requirements indicated without delaying the Work.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated on Drawings or specified elsewhere in this Section as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering insulation products that may be incorporated in the work include, but are not limited to, the following:

- B. Manufacturers: Subject to compliance with requirements, provide insulation products by one of the following:
 - 1. Glass-Fiber Insulation:
 - a. CertainTeed Corporation.
 - b. Knauf Fiber Glass GmbH.
 - c. Owens-Corning Fiberglas Corporation.
 - d. Schuller International, Inc.
 - e. Johns-Manville.

2.2 INSULATING MATERIALS

- A. General: Provide insulating materials that comply with requirements and with referenced standards.
 - 1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.
- C. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics. Provide with maximum recycled content available.

2.3 AUXILIARY INSULATING MATERIALS

- A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.
- B. Protection Board: Premolded, semirigid asphalt/fiber composition board, 1/4 inch (6 mm) thick, formed under heat and pressure, standard sizes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or that interfere with insulation attachment.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, unsoiled, and has not been exposed at any time to ice and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

- D. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
 - 1. Use blanket widths and lengths that fill cavities formed by framing members. Where more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
 - 2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
- B. Seal joints between closed-cell (nonbreathing) insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

3.5 PROTECTION

- A. General: Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07210

SECTION 07240 DAMPPROOFING FOR EXTERIOR SHEATHING

PART I – GENERAL

1.01 SUMMARY

This document contains all the manufacturer's requirements for the proper design, use, and installation of the dryvit backstop nt - smooth or texture air/water-resistive barrier. This document is intended to be used in conjunction with:

- A. Ds300 - backstop nt application instructions for use beneath claddings other than dryvit eifs
- B. Ds806 - backstop nt product data sheet for use beneath claddings other than dryvit eifs

1.02 REFERENCES

1. Astm c 297 standard test method for flatwise tensile strength of sandwich constructions
2. Astm c 1177 standard specification for glass mat gypsum substrate for use as sheathing
3. Astm c 1396 (formerly c 79) standard specification for gypsum board
4. Astm d 522 standard test methods for mandrel bend test of attached organic coatings
5. Astm d 2370 standard test method for tensile properties of organic coatings
6. Astm d 2247 (federal test standard 141a method 6201) standard practice for testing water resistance of coatings in 100% relative humidity
7. Astm e 72 standard methods for conducting strength tests of panels for building construction
8. Astm e 84 standard test method for surface burning characteristics of building materials
9. Astm e 96 standard test methods for water vapor transmission of materials
8. Astm e 283 standard test method for determining rate of air leakage through exterior windows, curtain walls and doors under specified pressure differences across the specimen
10. Astm e 331 test method for water penetration of exterior windows, skylights, doors and curtain walls by uniform static air pressure difference
11. Astm e 1233 standard test method for structural performance of exterior windows, curtain walls and doors by cyclic air pressure differential
12. Astm e 2178 standard test method for air permeance of building materials
13. Astm e 2357 standard test method for determining air leakage of air barrier assemblies
14. Astm e 2134 test method for evaluating the tensile-adhesion performance of exterior insulation and finish systems (eifs)
15. Astm e 2485 (formerly eima std. 101.01) standard test method for freeze-thaw resistance of exterior insulation and finish systems (eifs) and water-resistive barrier coatings
16. Astm e 2570 standard test methods for evaluating water-resistive barrier (wrb) coatings used under exterior insulation and finish systems (eifs) or eifs with drainage
17. Aatcc test method 127-2008 water resistance: hydrostatic pressure test
18. Federal specification tt-c-555b resistance to wind-driven rain

1.03 DEFINITIONS

- A. Contractor: the contractor that applies the backstop nt smooth or texture to the substrate.
- B. Sheathing: a substrate in sheet form.
- C. Substrate: the material to which the backstop nt smooth or texture is applied.
- D. Substrate system: the total wall assembly including the attached substrate to which the backstop nt – smooth or texture is applied.

- E. Air/water-resistive barrier materials: a combination of backstop nt smooth or texture and dryvit grid tape with aquaflesh[®] liquid and aquaflesh[®] mesh or dryvit flashing tape[™] and flashing tape conditioner[™].

1.04 DESCRIPTION

- A. General: dryvit backstop nt is available in smooth and texture and is a flexible polymer based, noncementitious, protective coating used as an air/water-resistive barrier when applied over acceptable exterior substrates.
- B. Design requirements
1. Apply at all exterior sheathing
 2. Backstop nt shall not be exposed to weather for longer than 30 days prior to being covered.
 3. Deflections of the substrate systems shall not exceed 1/240 times the span.

1.05 SUBMITTALS

- A. Product data – the contractor shall submit to the owner/architect manufacturer's product data sheets describing products that will be used on this project.
- B. Samples – as required for the specific cladding specified.

1.06 QUALITY ASSURANCE

- A. Qualifications
1. Product manufacturer: shall be dryvit systems, inc. All materials shall be manufactured or sold by dryvit and shall be purchased from dryvit or its authorized distributor.
 - A. Materials shall be manufactured at a facility covered by a current iso 9001:2008 and iso 14001:2004 certification. Certification of the facility shall be done by a registrar accredited by the american national standards institute, registrar accreditation board (ansi-rab).
 2. Contractor: shall be experienced and competent in the waterproofing trade.
- B. Certification
1. Backstop nt shall be recognized for the intended use by the applicable building code(s).

1.07 DELIVERY, STORAGE, AND HANDLING

- A. All dryvit materials shall be delivered to the job site in the original, unopened packages with labels intact.
- B. Upon arrival, materials shall be inspected for physical damage, freezing, or overheating. Questionable materials shall not be used.
- C. Materials shall be stored at the job site in a cool, dry location, out of direct sunlight, protected from inclement weather and other sources of damage. Minimum storage temperature shall be 4 °c (40 °f).

1.08 PROJECT CONDITIONS

- A. Environmental requirements
1. Application of wet materials shall not take place during inclement weather unless appropriate protection is provided. Protect materials from inclement weather until they are completely dry.
 2. At the time of application of backstop nt, the minimum air and wall surface temperatures shall be 4 °c

(40 °f) and rising. These temperatures shall be maintained, with adequate air ventilation and circulation, for a minimum of 12 hours thereafter, or until the products are dry.

- B. Existing conditions – the contractor shall have access to electric power, clean water, and a clean work area at the location where the dryvit backstop nt materials are to be applied.

1.09 SEQUENCING AND SCHEDULING

- A. Installation of the dryvit backstop nt shall be coordinated with other construction trades.

1.10 LIMITED MATERIALS WARRANTY

- A. Manufacturer's standard warranty.

PART II PRODUCT

2.01 MANUFACTURER

- A. All materials shall be obtained from dryvit or its authorized distributors. Substitutions or additions of materials other than those specified will void the warranty.

2.02 COMPONENTS

- A. Air/water-resistive barrier components:

1. Dryvit backstop nt: a flexible, polymer-based, noncementitious, water-resistive coating available in smooth and texture.
2. Dryvit grid tape™: an open weave fiberglass mesh tape with pressure sensitive adhesive available in rolls 102 mm (4 in) wide by 91 m (100 yds) long.

- B. Flashing materials: used to protect substrate edges at terminations.

1. Liquid applied: an extremely flexible water-based polymer material, ready for use.

A. Shall be aquaflash® liquid and aquaflash mesh

2. Sheet type:

A. Shall be flashing tape and surface conditioner

1) dryvit flashing tape™: a high density polyethylene film backed with a rubberized asphalt adhesive available in rolls 102 mm (4 in), 152 mm (6 in) and 229 mm (9 in) wide by 23 m (75 ft) long.

2) dryvit flashing tape surface conditioner™: a water-based surface conditioner and adhesion promoter for the dryvit flashing tape.

PART III EXECUTION

3.01 EXAMINATION

- A. Prior to application of backstop nt the contractor shall verify that the substrate:

1. Is of a type listed in section 1.04.b.1.
2. Is flat within 6.4 mm (1/4 in) in a 1.2 m (4 ft) radius.
3. Gaps do not exceed 6.4 mm (1/4 in). Larger gaps shall be corrected by replacing sheathing material.
4. Is sound, dry, connections are tight; has no surface voids, projections, or other conditions that may interfere with the application of backstop nt.

- B. Ambient and surface temperatures are minimum 4 °c (40 °f) and rising.

- C. The contractor shall notify the general contractor and/or architect and/or owner of all discrepancies. Work shall not proceed until discrepancies have been corrected.
- D. All roof/wall intersections, decks, balconies and other attachments, as well as eaves, chimneys, mechanical equipment, signage etc. Are properly flashed to divert water to the outside of the cladding.
- E. All openings and penetrations are properly flashed and wrapped with the air/water-resistive barrier to prevent water intrusion damage.

3.02 SURFACE PREPARATION

- A. The backstop nt materials shall be protected by permanent or temporary means from inclement weather and other sources of damage prior to, during, and following application until completely dry.
- B. Protect adjoining work and property during application of backstop nt.
- C. The substrate shall be prepared as to be free of foreign materials such as oil, dust, dirt, paint, wax, water repellents, moisture, frost and any other materials that inhibit adhesion.

3.03 INSTALLATION

- A. Backstop nt – smooth
 1. General: backstop nt – smooth is used in conjunction with dryvit backstop nt - texture joint treatment and shall be applied in accordance with current, published dryvit backstop nt application instructions for use beneath claddings other than dryvit eifs, ds300.
 2. Backstop nt – smooth is ready to use after an initial spin-up using a "twister" paddle or equivalent mixing blade, powered by a 12.7 mm (1/2 in) drill, at 450 – 500 rpm. Do not add cement or any other additive.
 3. Prior to backstop nt – smooth application, sheathing joints, including inside and outside corners, shall be treated with backstop nt – texture and dryvit grid tape. All fastener heads shall also be spotted with backstop nt – texture. Refer to backstop nt application instructions for use beneath claddings other than dryvit eifs, ds300, for complete details. Allow to dry a minimum of 2 hours or until dry to the touch. Cool humid conditions will require longer drying time.
 4. Apply backstop nt smooth over the entire wall surface, including previously treated fasteners and sheathing joints. Refer to the chart on the backstop nt product data sheet for use beneath claddings other than dryvit eifs, ds806, or application instructions for use beneath claddings other than dryvit eifs, ds300, for proper tools and respective coverage.
Note: applications over osb sheathing requires a minimum of 2 coats of backstop nt – smooth.
 5. Allow to dry a minimum of 24 hours prior cladding installation. Cool damp weather will require longer drying times.
 6. Install the specified dryvit exterior insulation and finish system per published installation instructions for the specific system being used. Application shall not exceed 400 square feet per pail.

3.04 FIELD QUALITY CONTROL

- A. The contractor shall be responsible for the proper application of the dryvit materials.
- B. The contractor and general contractor shall review and follow the backstop nt application instructions for use beneath claddings other than dryvit eifs, ds300.

3.05 CLEANING

- A. All excess dryvit materials shall be removed from the job site by the contractor in accordance with contract provisions.
- B. All surrounding areas, where dryvit materials have been installed, shall be left free of debris and foreign substances resulting from the contractor's work.

3.06 PROTECTION

- A. The dryvit materials and the project shall be protected from damage and inclement weather until dry.
 - 1. The dryvit backstop nt – smooth or texture shall not be exposed for longer than 30 days prior to being covered with the specified building cladding.

End of Section 07240

SECTION 07542 – THERMOPLASTIC POLYOLEFIN (TPO) MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. TPO Mechanically fastened membrane roofing system.
- B. Roof insulation.

1.2 RELATED SECTIONS

- A. Division 05 Section "Steel Decking" for steel roof deck.
- B. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, cants, curbs, and blocking [and for wood-based, structural-use roof deck panels].
- C. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counter flashings not included in this section. Requirements of this section shall govern.

1.3 REFERENCES

- A. Roofing Terminology: Refer to the following publications for definitions of roofing work related terms in this Section:
 - 1. ASTM D 1079 "Terminology Relating to Roofing and Waterproofing."
 - 2. Glossary of NRCA's "The NRCA Roofing and Waterproofing Manual."
 - 3. Roof Consultants Institute "Glossary of Roofing Terms."
- B. Sheet Metal Terminology and Techniques: SMACNA "Architectural Sheet Metal Manual."

1.4 DESIGN CRITERIA

- A. General: Installed roofing membrane system shall remain watertight; and resist specified wind uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Roofing materials shall be compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.

- C. Installer must comply with current code requirements based on authority having jurisdiction.
- D. Wind Uplift Performance: Roofing system shall be identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist wind uplift pressure calculated in accordance with ASCE 7.

1.5 SUBMITTALS

- A. Product Data: Manufacturer's data sheets for each product to be provided.
- B. Detail Drawings: Provide roofing system plans, elevations, sections, details, and details of attachment to other Work, including:
 - 1. Base flashings, cants, and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Crickets, saddles, and tapered edge strips, including slopes.
 - 4. Insulation fastening patterns.
- C. Verification Samples: Provide for each product specified.
- D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- E. Maintenance Data: Refer to Johns Manville's latest published documents on www.JM.com.
- F. Guarantees: Provide manufacturer's current guarantee specimen.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive the specified manufacturer's guarantee.
- B. Manufacturer Qualifications: Qualified manufacturer that has UL listing for roofing system identical to that used for this Project.
- C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E329.
- D. Test Reports:
 - 1. Roof drain and leader test or submit plumber's verification.
 - 2. Roof deck fastener pullout test.

- E. Source Limitations: Obtain all components from the single source roofing manufacturer guaranteeing the roofing system. All products used in the system must be labeled by the single source roofing manufacturer issuing the guarantee.
- F. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
 - 1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.
 - 2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when current and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and guarantee requirements.

1.9 GUARANTEE

- A. Provide manufacturer's system guarantee equal to Johns Manville's Peak Advantage No Dollar Limit Roofing System Guarantee.
 - 1. Single-Source special guarantee includes roofing membrane, base flashings, liquid applied flashing, roofing membrane accessories, roof insulation, fasteners, walkway products, manufacturer's expansion joints, manufacturer's edge metal

products, and other single-source components of roofing system marketed by the manufacturer.

2. Guarantee Period: 20 years from date of Substantial Completion.

B. Installer's Guarantee: Submit roofing Installer's guarantee, including all components of roofing system for the following guarantee period:

1. Guarantee Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC POLYOLEFIN ROOFING MEMBRANE - TPO

A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: ASTM D 6878, uniform, flexible sheet formed from a thermoplastic polyolefin, internally fabric or scrim reinforced. Basis of Design: JM TPO

1. Thickness: 60 mils (1.52 mm), nominal
2. Exposed Face Color: White

2.2 AUXILIARY ROOFING MATERIALS – SINGLE PLY

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's internally reinforced or scrim reinforced, smooth backed membrane with same thickness and color as sheet membrane. Basis of Design: JM TPO

C. Bonding Adhesive: Manufacturer's standard solvent-based bonding adhesive for base flashings. Basis of Design: JM TPO Membrane Adhesive (Solvent Based)

D. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, with anchors. Basis of Design: JM Termination Systems

E. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer. Basis of Design: High Load Fasteners and Plates

F. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, cover

strips, and other accessories. Basis of Design: [JM TPO Pourable Sealer A & B, JM TPO Pipe Boots, JM TPO Universal Corners, JM TPO Edge Sealant, JM TPO T-Joint Patch, JM TPO Membrane Cleaner, JM TPO Membrane Primer, JM TPO Membrane Primer (Low VOC), JM TPO Sealing Mastic, JM TPO Cover Tape, JM TPO Detail Membrane, JM TPO Peel & Stick 10" RPS, JM TPO Peel & Stick 6" RTS, JM TPO-Coated Metal, JM TPO Detail Membrane and JM Single Ply Caulk]

2.3 AUXILIARY ROOFING SYSTEM COMPONENTS

- A. Expansion Joints: Provide factory fabricated weatherproof, exterior covers for expansion joint openings consisting of flexible rubber membrane, supported by a closed cell foam to form flexible bellows, with two metal flanges, adhesively and mechanically combined to the bellows by a bifurcation process. Provide product manufactured and marketed by single-source membrane supplier that is included in the No Dollar Limit guarantee. Basis of Design: Expand-O-Flash
- B. Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 Section "Sheet Metal Flashing and Trim."

2.4 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads sourced from membrane roofing system manufacturer. Basis of Design: JM TPO Walkpad

2.5 ROOF INSULATION

- A. General: Preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 (20 psi), Basis of Design: ENRGY 3
 - 1. Provide insulation package with minimum R Value: 20.
 - 2. Provide insulation package with minimum thickness: 3.5 inches.
 - 3. Provide insulation package in multiple layers.
 - 4. Minimum Long-Term Thermal Resistance (LTTR): 5.7 per inch.
 - a. Determined in accordance with CAN/ULC S770 at 75°F (24°C)

2.6 TAPERED INSULATION (WHERE REQUIRED)

- A. Tapered Insulation: ASTM C 1289, Type II, Class 1, Grade 2 (20 psi), provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48), unless otherwise indicated. Basis of Design: Tapered ENRGY 3

2.7 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
- B. Provide factory preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated. Basis of Design: Diamondback Pre-Cut Cricket Diamondback Pre-Cut Miter Tapered Fesco Edge Strip
- C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and furnished by roofing system manufacturer. Basis of Design: UltraFast Fasteners and Plates
- D. Wood Nailer Strips: Comply with requirements in Division 06 Section "Miscellaneous Rough Carpentry."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with the requirements affecting performance of roofing system.
 - 1. General:
 - a. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
 - b. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 2. Steel Decks:
 - a. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."
 - 3. Ensure general rigidity and proper slope for drainage.

4. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch (1.6 mm) out of plane relative to adjoining deck.
- B. Unacceptable panels should be brought to the attention of the General Contractor and Project Owner's Representative and must be corrected prior to installation of roofing system.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and remove from substrate sharp projections, dust, debris, moisture, and other substances detrimental to roofing installation in accordance with roofing system manufacturer's written instructions.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 RE-ROOF PREPARATION

- A. Remove all roofing membrane, surfacing, coverboards, insulation, fasteners, asphalt, pitch, adhesives, etc.
 1. Remove an area no larger than can be re-roofed in one day.
- B. Tear out all base flashings, counterflashings, pitch pans, pipe flashings, vents and like components necessary for application of new membrane.
- C. Remove abandoned equipment curbs, skylights, smoke hatches, and penetrations.
 1. Install decking to match existing as directed by Owner's Representative.
- D. Raise (disconnect by licensed craftsmen, if necessary) all HVAC units and other equipment supported by curbs to conform with the following:
 1. Modify curbs as required to provide a minimum 8" base flashing height measured from the surface of the new membrane to the top of the flashing membrane.
 2. Secure of flashing and install new metal counterflashing prior to re-installation of unit.
 3. Perimeter nailers must be elevated to match elevation of new roof insulation.
- E. Immediately remove all debris from roof surface. Demolished roof system may not be stored on the roof surface.

- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 INSULATION INSTALLATION

- A. Coordinate installation of roof system components so insulation and cover board is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with roofing system manufacturer's written instructions for installation of roof insulation and cover board.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation boards with long joints in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with like material.
- E. Install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
- F. Trim surface of insulation boards where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- G. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
- H. Preliminarily Fastened Insulation for Mechanically Fastened Systems: Install insulation with fasteners at rate required by roofing system manufacturer or applicable authority, whichever is more stringent.
 - 1. Fasten top layer to resist uplift pressure at corners, perimeter, and field of roof.
- I. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 ROOFING MEMBRANE INSTALLATION, GENERAL

- A. Install roofing membrane in accordance with roofing system manufacturer's written instructions, applicable recommendations of the roofing manufacturer and requirements in this Section.
- B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.
- C. Where roof slope exceeds 1/2 inch per 12 inches (1:24), contact the membrane manufacturer for installation instructions regarding installation direction and backnailing.

- D. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.
- E. Coordinate installing roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is imminent.
 - 1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.
 - 2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
 - 3. Remove and discard temporary seals before beginning work on adjoining roofing.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.6 MECHANICALLY FASTENED ROOFING MEMBRANE INSTALLATION

- A. Install roofing membrane over area to receive roofing in accordance with roofing system manufacturer's written instructions.
 - 1. Unroll roofing membrane and allow to relax before installing.
 - 2. Install sheet in accordance with roofing system manufacturer's written instructions.
- B. Accurately align roofing membranes and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- C. Mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.
- D. Always install membrane laps perpendicular to the steel deck flutes. "Picture Frame" installation method is not permitted.
- E. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
- F. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.
 - 2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.

- a. Remove and repair any unsatisfactory sections before proceeding with Work.
3. Repair tears, voids, and lapped seams in roofing membrane that do not meet requirements.
- G. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.
 - H. In-Splice Attachment: Secure one edge of roofing membrane using fastening plates or metal battens centered within membrane splice and mechanically fasten roofing membrane to roof deck. Field-splice seam.
 - I. Install roofing membrane and auxiliary materials to tie in to existing roofing.
 - J. Proceed with installation only after unsatisfactory conditions have been corrected.

3.7 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply solvent-based bonding adhesive at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners per manufacturer's installation instructions.
- D. Clean seam areas and overlap 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 and mechanically anchor to substrate through termination bars.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.8 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Heat-weld walkway products to substrate according to roofing system manufacturer's written instructions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's Registered Roof Observer (RRO) to inspect roofing installation on completion and submit report to Architect.
 - 1. Notify Architect or Owner 48 hours in advance of date and time of inspection.
- C. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 PROTECTION AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075423

SECTION 07600 - FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Provide all labor, equipment, and materials fabricate and install the following.

1. Edge strip and flashing.
2. Fascia, scuppers, and trim.
3. Counterflashings over bituminous base flashing.
4. Counterflashings for roof accessories.
5. Counterflashings at roof mounted equipment and vent stacks.
6. Base flashing coverings.
7. Coping cap at parapets.
8. Expansion joint and area divider covers.
9. Panelized wall covering systems
10. Fascia and edge metal.
11. Gutters, scuppers and down spouts.
12. Counterflashings at walls and penetrations.
13. Lead flashing for bituminous membranes.
14. Other components.

1.2 RELATED SECTIONS

A. Drawing and general provisions of the Contract, including General Supplementary Conditions and Division 1 Specification Sections, Apply to this Section.

B. RELATED SECTIONS

1. Section 06100 - Rough Carpentry
2. Section 07550 - Modified Bitumen Roofing
3. Section 07720 - Roof Accessories
4. Section 07900 - Joint Sealants

1.3 REFERENCES

ASTM A-446	Specification for steel sheet
ASTM B-209	Specification for aluminum sheet
ASTM B-221	Specification for aluminum extruded shape
FS QQ-L-201	Specification for Lead Sheet
ASTM A792	Steel Sheet, Aluminum-Zinc Alloy-Coated, by the Hot-Dip Process
ASTM B32	Solder Metal
ASTM B209	Aluminum and Alloy Sheet and Plate
ASTM B486	Paste Solder
ASTM D226	Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D486	Asphalt Roof Cement, Asbestos-free
FS O-F-506	Flux, Soldering, Paste and Liquid
WH	Warnock Hersey International, Inc. Middleton, WI.
FM	Loss Prevention Data Sheet
NRCA	National Roofing Contractors Association - Roofing Manual
SMACNA	Architectural Sheet Metal Manual

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300 - Submittals.
- B. Product Data: Provide manufacturer's specification data sheets for each product in accordance with Section 01300.

1.5 QUALITY CONTROL

- A. Reference Standards
 - 1. Comply with details and recommendations of SMACNA Manual for workmanship, methods of joining, anchorage, provisions for expansion, etc.
 - 2. Factory Mutual Loss Prevention Data Sheet 1-49 windstorm resistance 1-90.
- B. Contractor's Warranty
 - 1. The Contractor shall provide the Owner with a notarized written warranty assuring that all sheet metal work including caulking and fasteners to be watertight and secure for a period of two years from the date of final acceptance of the building. Warranty shall include all materials and workmanship required to repair any leaks that develop, and make good any damage to other work or equipment caused by such leaks or the repairs thereof.

1.6 QUALIFICATIONS

- A. Fabricator and Installer: Company specializing in sheet metal flashing work with 5 years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original, unopened containers or packages with labels intact and legible.
- B. Stack pre-formed and pre-finished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials which may cause discoloration or staining.

PART 2 - PRODUCTS

2.1 APPROVED EQUIVALENT

- A. Contractor must submit any product not specified a minimum five days before the bid date to Architect in order for product to be considered for approval. The Architect will notify Contractor, in writing, of decision to accept or reject request.

2.2 MATERIALS

- A. Metal system is to be comprised of minimum Aluminum or Galvalume steel, coated on both sides with an epoxy primer and on the weathering surface with a polyvinylidene fluoride or siliconized polyester baked organic coated finish.
 - 1. All materials/finished to match the Composite Metal Panels.
 - 2. The pressure bar will be 24 gauge G-90 galvanized.
 - 3. The scuppers will be 20 gauge galvanized.

2.3 RELATED MATERIALS

- A. Metal Primer: Zinc chromate type.
- B. Plastic Cement: ASTM D 4586
- C. Sealant: Specified in Section 07900 or on drawings.
- D. Lead: Meets Federal Specification QQ-L-201, Grade B, four pounds per square foot.
- E. Solder: ANSI/ASTM B32; 95/05 type.
- F. Flux: FS O-F-506.
- G. Underlayment: ASTM D2178, No15 asphalt saturated roofing felt.
- H. Slip Sheet: Rosin sized building paper.
- I. Fasteners:
 - 1. Corrosion resistant screw fastener as recommended by metal manufacturer. Finish exposed fasteners same as flashing metal.
 - 2. Fastening shall conform to Factory Mutual 1-90 requirements or as stated on section details, whichever is more stringent.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install work watertight, without waves, warps, buckles, fastening stress, or distortion, allowing for expansion and contraction.
- B. Fastening of metal to walls and wood blocking shall comply with SMACNA Architectural Sheet Metal Manual, Factory Mutual I-90 wind uplift specifications and/or manufacturer's recommendations whichever is of the highest standard.
- C. All accessories or other items essential to the completeness of sheet metal installation, whether specifically indicated or not, shall be provided and of the same material as item to which applied.
- D. Metal fascia and copings shall be secured to wood nailers at the bottom edge with a continuous cleat. Cleats shall be at least one gauge heavier than the metal it secures.

3.3 INSPECTION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets are in place, and nailing strips located.
- B. Verify membrane termination and base flashings are in place, sealed, and secure.
- C. Beginning of installation means acceptance of existing conditions.
- D. Field measure site conditions prior to fabricating work.

3.4 SHOP FABRICATED SHEET METAL

- A. Installing Contractor shall be responsible for determining if the sheet metal systems are in general conformance with roof manufacturer's recommendations.
- B. Metal work shall be shop fabricated to configurations and forms in accordance with recognized sheet metal practices.
- C. Hem exposed edges.
- D. Angle bottom edges of exposed vertical surfaces to form drip.
- E. All corners for sheet metal shall be lapped with adjoining pieces fastened and set in sealant.
- F. Joints for gravel stop fascia system, cap flashing, and surface-mount counterflashing shall be formed with a 1/4" opening between sections. The opening shall be covered by a cover plate or backed by an internal drainage plate formed to the profile of fascia piece. The cover plate shall be embedded in mastic, fastened through the opening between the sections and loose locked to the drip edges.
- G. Install sheet metal to comply with Architectural Sheet Metal manual, Sheet Metal and Air Conditioning Contractor's National Associations, Inc.

3.6 FLASHING MEMBRANE INSTALLATION

A. METAL EDGE DETAIL

- 1. See details for scuppers. For manufactured edge metal, scuppers shall be factory fabricated.
- 2. Accessories: Joint covers, corners, supports, strip flashing at joining, fastenings and other accessories shall be included.
- 3. Install continuous cleat fasten 6" O.C. Fasten flange to wood nailer every 6" staggered.
- 4. Install new metal edge hooked to continuous cleat.
- 5. Prime metal edge at a rate of 100 square feet per gallon and allow to dry.

B. DRIP EDGE DETAIL

1. Accessories: Joint covers, seam sealant, seam tape, fasteners, and other accessories shall be included.
2. Install continuous cleat fasten 6" O.C. Fasten flange to hat channel 1 1/4" O.C. with seam tape between metal edge and roof membrane.
3. Install new metal edge hooked to continuous cleat.
4. Metal edge pieces shall be overlapped a minimum of 2", or butted at ends with internal drainage plate or sealed batten cover.

C. RAISED METAL EDGE DETAIL

1. See details for scuppers. For manufactured edge metal, scuppers shall be factory fabricated.
2. Accessories: Joint covers, corners, supports, strip flashing at joining, fastenings and other accessories shall be included.
3. Install continuous cleat fasten 6" O.C. Fasten flange to wood nailer every 6" staggered.
4. Install new metal edge hooked to continuous cleat.
5. Prime metal edge at a rate of 100 square feet per gallon and allow to dry.

D. ROOF EDGE WITH GUTTER

1. Install gutter and strapping.
2. Accessories: Joint covers, corners, supports, strip flashing at joining, fastenings and other accessories shall be included.
3. Install continuous cleat fasten 6" O.C.
4. Install new metal edge hooked to continuous cleat.
5. Prime metal edge at a rate of 100 square feet per gallon and allow to dry.

E. COPING CAP DETAIL

1. Accessories: Joint covers, seam sealant, seam tape, caulking, fasteners, and other accessories shall be included.
2. Install continuous cleats on outside of wall and fasten 6" O.C. Fasten coping cap on inside of wall 6" O.C.
3. Install new coping cap hooked to continuous cleat.
4. Metal edge pieces shall be overlapped a minimum of 2", or butted at ends with internal drainage plate or sealed batten cover.

F. SURFACE MOUNTED COUNTERFLASHING/COPING CAP

1. Copings shall be provided with factory fabricated welded watertight coping accessories such as miters, transitions, end caps, etc. and finished to match coping system.

2. Accessories: Joint covers, corners, supports, strip flashing at joinings, fastening, and other accessories shall be included.
3. Install continuous cleat fasten 6" O.C.
4. Install new coping cap hooked to continuous cleat.

G. SURFACE MOUNTED COUNTERFLASHING

1. Counterflashing shall be provided with watertight accessories such as miters, transitions, end caps, etc. and finished to match counterflashing.
2. Accessories: Joint covers, corners, fasteners, strip flashing at joinings, fastening, and other accessories shall be included.
3. Apply butyl tape to wall behind flashing. Secure termination bar through flashing butyl tape and into wall.
4. Secure new counterflashing set on a butyl tape above flashing 8" O.C., caulk top of counterflashing.

H. EXPANSION JOINT

1. Expansion Joint shall be provided with watertight accessories such as miters, transitions, end caps, etc. and finished to match.
2. Accessories: Joint covers, corners, fasteners, strip flashing at joinings, fastening, and other accessories shall be included.
3. Install compressible insulation in neoprene cradle.
4. Install pre-manufactured expansion joint cover. Fasten sides 12" O.C. with fasteners and neoprene washers.
5. All joint cover laps will have butyl tape in between metal covers.

I. EQUIPMENT SUPPORT

1. Covers shall be provided with watertight accessories such as miters, transitions, end caps, etc. and finished to match.
2. Accessories: Joint covers, corners, fasteners, strip flashing at joinings, fastening, and other accessories shall be included.
3. Install pre-manufactured expansion joint cover. Fasten sides 24" O.C. with fasteners and neoprene washers. All joint cover laps will have butyl tape in between metal covers.
4. Set equipment on neoprene pad and fasten as required by equipment manufacturer.

J. CURB DETAIL/AIR HANDLING STATION

1. Counterflashing shall be provided with watertight accessories such as miters, transitions, end caps, etc. and finished to match.

2. Accessories: Joint covers, corners, fasteners, strip flashing at joinings, fastening, and other accessories shall be included.
3. Install pre-manufactured expansion joint cover. Fasten sides 8" O.C. with fasteners and neoprene washers.
4. Set equipment on neoprene pad and fasten as required by equipment manufacturer.

K. HEAT STACK

1. Prime flange and sleeve at a rate of 100 square feet per gallon and allow to dry.
2. Install properly sized sleeves in a 1/4" bed of elastomeric sealant.
3. Install new collar over cape. Weld collar or install stainless steel draw band.
4. Caulk intersection of the membrane and flange with elastomeric sealant.

END OF SECTION 07600

SECTION 07900 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes joint sealants for the applications indicated in the Joint-Sealant Schedule at the end of Part 3.
- B. Related Sections include the following:
 - 1. Division 4 Section "Unit Masonry Assemblies" for masonry control and expansion joint fillers and gaskets.
 - 2. Division 7 Section "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
 - 3. Division 8 Section "Glazing" for glazing sealants.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Qualification Data: For Installer.
- D. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.
- E. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Field Test Report Log: For each elastomeric sealant application.

- G. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.
- H. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints as directed by Architect.
 - 2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 - 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 - 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - 5. Test Method: Test joint sealants according to the following hand pull method:
 - a. Install joint sealants in 5-foot joint lengths using same materials and methods for joint preparation and joint sealant installation required for completed work. Allow sealants to cure fully before testing.
 - b. Make knife cuts as follows: A horizontal cut from one side of joint to the other followed by 2 vertical cuts approximately 2 inches long at side of joint and meeting horizontal cut at top of 2 inch cuts. Place a mark 1 inch from top of 2 inch piece.
 - c. Use fingers to grasp 2 inch piece of sealant just above 1 inch mark; pull firmly down at a 90 degree angle or more while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
 - d. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
- A. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
Evaluation of Preconstruction Field-Adhesion- Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

- D. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
 - 1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
 - 5. Unless specifically indicated on the Drawings, no joints shall exceed W' and will be rejected by the Architect.

1.7 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: 5 years from date of Final Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: 5 years from date of Final Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

Generally, sealant colors shall match color of adjacent materials.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Single-Component Neutral- and Basic-Curing Silicone Sealant **ES-1**:

1. Products:

- a. Dow Corning Corporation; 790.
- b. GE Silicones; SilPrufLM SCS2700.
- c. Tremco; Spectrem 1 (Basic).
- d. GE Silicones; SilPruf SCS2000.
- e. Pecora Corporation; 864.
- f. Pecora Corporation; 890.
- g. Polymeric Systems Inc.; PSI-641.
- h. Sonneborn, Division of ChemRex Inc.; Omniseal.
1. Tremco; Spectrem 3.

2. Type and Grade: S (single component) and NS (nonsag).

3. Class: 50 or *100150*.

4. Use Related to Exposure: NT (nontraffic).

5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

- a. Use **O** Joint Substrates: Color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, brick, and wood.

C. Single-Component Mildew-Resistant Neutral-Curing or Acid Curing Silicone Sealant **ES-2**:

1. Products:

- a. Dow Corning - 786.
- b. Pecora Corporation; 898.
- c. Tremco; Treinsil200 Sanitary.

2. Type and Grade: S (single component) and NS (nonsag).

3. Class: 25.

4. Use Related to Exposure: NT (nontraffic).

5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

a. Use **O** Joint Substrates: Ceramic tile.

D. Single-Component Nonsag Urethane Sealant **ES-3**:

1. Products:

- a. Bostik Findley; Chem-Calk 900.
- b. Bostik Findley; Chem-Calk 915.
- c. Pecora Corporation; Dynatrol I-XL.
- d. Polymeric Systems Inc.; PSI-901.

- e. Tremco; DyMonic.
 - 2. Type and Grade: S (single component) and 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.
 - a. Use O Joint Substrates: Color anodic aluminum, aluminum coated with a high-performance coating, and galvanized steel.
- E. Multicomponent Single Component Urethane Sealant **ES-4**:
- 1. Products:
 - a. Pecora Corp.; Dynatrol 1
 - b. Sika Corporation, Inc.; Sikaflex -1a
 - c. Tremco; Dymonic
 - d. Sherwin Williams: LOXON 1K Smooth (S1)
 - 2. Type and Grade: S (Singlecomponent) and NS (Nonsag). Use Nonsag on joints over $\frac{3}{4}$ ".
 - 3. Class: 12-1/2.
 - 4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
 - 5. Uses Related to Joint Substrates: M, A.
- F. Single-Component Pourable Urethane Sealant **ES-5**:
- 1. Products:
 - a. Bostik Findley; Chem-Calk 950.
 - b. Pecora Corporation; Urexpan NR-201.
 - c. Polymeric Systems Inc.; Flexiprene 952.
 - d. Sonneborn, Division of ChemRex, Inc.; SL1.
 - e. Tremco; Tremflex SIL.
 - f. Tremco; Vulkem 45.
 - g. Sika Corporation, Inc.; Sikaflex - 1 CSL
 - 2. Type and Grade: S (single component) and P (pourable).
 - 3. Class: 25 or 50.
 - 4. Use Related to Exposure: T (traffic).
 - 5. Uses Related to Joint Substrates: M, and, as applicable to joint substrates indicated, O.

2.4 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), unless not acceptable to the joint sealant manufacturer' for the joint application indicated and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 - 1. If Manufacturer indicates a problem with the specified closed-cell material for the joint application, Contractor shall use backing recommended by the Manufacturers.

2.5 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- 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 joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 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.
- B. Proceed with installation only after unsatisfactory conditions have been corrected

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions 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, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean 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 after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean 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. Nonporous joint substrates include the following:

- a. Metal.
- B. Joint Priming: Prime joint substrates based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. 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.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure SA in ASTM C 1193, unless otherwise indicated.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants 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 installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application JS-1: Exterior vertical and horizontal nontraffic construction joints in cast-in-place concrete.
 - 1. Joint Sealant: Single-component neutral- and basic-curing silicone sealant **ES-1**.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match color of concrete.
- B. Joint-Sealant Application JS-2: Exterior horizontal traffic isolation and contraction joints in cast-in-place concrete slabs.
 - 1. Joint Sealant: Single-component pourable urethane sealant **ES-5**.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match adjacent materials.
- C. Joint-Sealant Application JS-3: Exterior vertical and horizontal nontraffic joints between plant-precast architectural concrete units.
 - 1. Joint Sealant: Single-component neutral- and basic-curing silicone sealant **ES-1**.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match precast.
- D. Joint-Sealant Application JS-4: Exterior vertical control and expansion joints in unit masonry.
 - 1. Joint Sealant: Single-component neutral- and basic-curing silicone sealant **ES-1**.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match color of adjacent materials.
- E. Joint-Sealant Application JS-5: Exterior joints in exterior insulation and finish systems and/or direct applied exterior finish systems.
 - 1. Joint Sealant: Single-component neutral- and basic-curing silicone sealant **ES-1**.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match color of EIFSIDEFS systems.
- F. Joint-Sealant Application JS-6: Exterior vertical joints between different materials listed above.

1. Joint Sealant: Single-component neutral- and basic-curing silicone sealant **ES-1**.
 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match color of adjacent materials.
- G. Joint-Sealant Application JS-7: Exterior perimeter joints between unit masonry and/or precast and frames of doors windows and louvers.
1. Joint Sealant: Single-component neutral- and basic-curing silicone sealant **ES-1**.
 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match color of adjacent materials.
- H. Joint-Sealant Application JS-8: Vertical control and expansion joints and emu comers on interior walls up to a height of 10'-0" for pick resistance. Above 10'-0", use joint-sealant application JS-9.
1. Joint Sealant: Multicomponent nonsag pick resistant urethane sealant **ES-4**.
 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match color of adjacent materials.
- I. Joint-Sealant Application JS-9: Vertical control and expansion joints and emu comers on interior walls above 10'-0". Use joint-sealant application JS-8 for joints below 10'-0".
- J. Joint Sealant: Single-component nonsag urethane sealant **ES-4**
- K. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match color of adjacent materials.
- J. Joint-Sealant Application JS-10: Interior perimeter joints of openings.
1. Joint Sealant: Single-component non sag urethane sealant **ES-4**.
 2. Joint-Sealant Color: As selected by Architect. from manufacturer's full range to match color of adjacent materials.
- K. Joint-Sealant Application JS-11: Interior joints between plumbing fixtures and adjoining walls, floors, and counters.
1. Joint Sealant: Single-component mildew-resistant neutral-curing silicone sealant **ES-2**.
 2. Joint-Sealant Color: White
- L. Joint-Sealant Application JS-12: Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances, countertops and other materials not indicated elsewhere.
1. Joint Sealant: Single-component non-sag urethane sealant. **ES-4**
 2. Joint-Sealant Color: As selected by Architect from manufacturer's. full range to match color of adjacent surfaces.
- M. Joint-Sealant Application JS-13: Interior exposed joints in horizontal traffic surfaces not covered elsewhere.
1. Joint Sealant: Single component pourable urethane sealant. **ES-5**
 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match color of adjacent surfaces.

- N. Joint-Sealant Application JS-13: Interior exposed joints in horizontal traffic surfaces in Exposed Polished Concrete.
 - 3. Joint Sealant: As recommended by Polished Concrete contractor.
 - 4. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match color of adjacent surfaces.

END OF SECTION 07920

SECTION 08110 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes steel doors and frames.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 4 Section "Unit Masonry" for building anchors into and grouting frames in masonry construction.
 - 2. Division 8 Section "Flush Wood Doors" for hollow-core and solid-core wood doors installed in steel frames.
 - 3. Division 8 Section "Door Hardware" for door hardware and weatherstripping.
 - 4. Division 8 Section "Glazing" for glass in steel doors and sidelights.
 - 5. Division 9 Section "Painting" for field painting primed doors and frames.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.
- C. 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.
- D. Door Schedule: Submit schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings.
 - 1. Indicate coordination of glazing frames and stops with glass and glazing requirements.

1.4 QUALITY ASSURANCE

- A. Provide doors and frames complying with ANSI/SDI 100 "Recommended Specifications for Standard Steel Doors and Frames" and as specified.
- B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies tested for fire-test-response characteristics per NFPA 252 for positive pressure, and are labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 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 Architect; otherwise, remove and replace damaged items as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4-inch- (100-mm-) 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 (6-mm) spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Steel Doors and Frames:
 - a. Amweld Building Products, Inc.
 - b. Curries
 - c. Ceco Door Products.
 - d. Republic Builders Products.
 - e. Steelcraft.

2.2 MATERIALS

- A. Supports and Anchors: Fabricated from not less than 0.0478-inch- (1.2-mm-) thick steel sheet; 0.0516-inch- (1.3-mm-) thick galvanized steel where used with galvanized steel frames.
- B. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize complying with ASTM A 153, Class C or D as applicable.

2.3 DOORS

- A. Steel Doors: Provide 1-3/4-inch- (44-mm-) thick doors of materials and ANSI/SDI 100 grades and models specified below, or as indicated on Drawings or schedules:
 - 1. Interior Doors: SDI-100, Grade II, heavy duty, Model 1, Minimum 18-gauge faces.
 - 2. Exterior Doors: SDI-100, Grade III, extra heavy-duty, Model 2, Minimum 16-gauge faces.
- B. Door Louvers: Provide louvers according to SDI 111C for interior doors where indicated, with blades or baffles formed of 0.0239-inch- (0.6-mm-) thick cold-rolled steel sheet set into minimum 0.0359-inch- (0.9-mm-) thick steel frame.

2.4 FRAMES

- A. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, according to ANSI/SDI 100, and of types and styles as shown on Drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 16 gauge thick cold-rolled steel sheet.

1. Fabricate frames with mitered or coped and continuously welded corners.
2. Fabricate frames for interior openings over 48 inches (1220 mm) wide from 0.0598-inch- (1.5-mm-) thick steel sheet.
3. Fabricate exterior frames for openings over 48 inches (1220 mm) wide from 0.0635-inch- (1.6-mm-) thick galvanized steel sheet.
4. Form exterior frames from 0.0635-inch- (1.6-mm-) thick galvanized steel sheet.
5. Provide grout tight mortar/junction boxes at the electric power transfers (EPT), and door monitor switch locations. Provide conduit from mortar boxes to a junction box inside of the building located above the ceiling. Provide screw on cover plates for future EPTs as scheduled. See applicable hardware sets in finish hardware section 08710 for specific locations.

- B. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-door frames and 2 silencers on heads of double-door frames.
- C. Plaster Guards: Provide minimum 0.0179-inch- (0.45-mm-) thick steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.
- D. Grout: When required in masonry construction, as specified in Division 4 Section "Unit Masonry."

2.5 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. Comply with ANSI/SDI 100 requirements.
1. Internal Construction: One of the following manufacturer's standard core materials according to SDI standards:
 - a. Resin-impregnated paper honeycomb.
 - b. Rigid polyurethane conforming to ASTM C 591.
 - c. Rigid polystyrene conforming to ASTM C 578.
 - d. Unitized steel grid.
 - e. Vertical steel stiffeners.
 - f. Rigid mineral fiber with internal sound deadener on inside of face sheets.
 2. Clearances: Not more than 1/8 inch (3.2 mm) at jambs and heads, except not more than 1/4 inch (6.4 mm) between non-fire-rated pairs of doors. Not more than 3/4 inch (19 mm) at bottom.
 - a. Fire Doors: Provide clearances according to NFPA 80.
- B. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel sheet.
- C. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.
- E. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
- F. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable

requirements of SDI 107 and ANSI A115 Series specifications for door and frame preparation for hardware.

1. Provide grout tight mortar/junction boxes at the electric power transfers (EPT), and door monitor switch locations. Provide conduit from mortar boxes to a junction box inside of the building located above the ceiling. Provide screw on cover plates for future EPTs as scheduled. See applicable hardware sets in finish hardware section 08710 for specific locations.
- G. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
- H. Locate hardware as indicated on Shop Drawings or, if not indicated, according to the Door and Hardware Institute's (DHI) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
- I. Glazing Stops: Minimum 0.0359-inch- (0.9-mm-) thick steel or 0.040-inch- (1-mm-) thick aluminum.
1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
 2. Provide screw-applied, removable, glazing beads on inside of glass, louvers, and other panels in doors.
- 2.6 FINISHES, GENERAL
- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
1. Shop Primer: Manufacturer's standard, fast-drying, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
- B. Comply with NAAMM's "Metal Finishes Manual" for recommendations relative to applying and designating finishes.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.
- B. Placing Frames: Comply with provisions of SDI 105, unless otherwise indicated. 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.
1. Except for frames located in existing concrete, masonry, or gypsum board assembly construction, place frames before constructing enclosing walls and ceilings.
 2. In masonry construction, install at least 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
 3. Install fire-rated frames according to NFPA 80.
- C. Door Installation: Fit hollow-metal doors accurately in frames, within clearances specified in ANSI/SDI 100.

1. Fire-Rated Doors: Install with clearances specified in NFPA 80.
2. Smoke-Control Doors: Comply with NFPA 105.

3.2 ADJUSTING AND CLEANING

- A. Prime Coat Touchup: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
- B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 08110

SECTION 08150 - IMPACT RESISTANT DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification Section apply to this section.
- B. Furnish all labor materials, tools, equipment and services for Impact Resistant Doors. Provide and install all miscellaneous items, appurtenances and devices, incidental to or necessary for a sound, secure and complete system.
- C. Related Work:
 - 1. Steel Doors and Frames, Aluminum Storefront Systems, Door Hardware

1.2 REFERENCES

- A. Industry Standards: Some products and execution are specified in this section by reference to published specifications or standards of the following, with respective abbreviations used.
 - 1. ASTM The American Society for Testing & Materials
 - 2. AAMA American Architectural Manufacturers Association

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, specifications and instructions for each type of door and frame required the following:
 - 1. Include details of core, stile and rail construction, trim for lites and all other components.
 - 2. Include details of finish hardware mounting.
 - 3. Include samples of each aluminum alloy to be used on this project. Where normal finish color and texture variations are expected, include two or more samples to show the range of such variations.
 - 4. Include one sample of typical fabricated section, showing joints, fastenings, quality of workmanship, hardware and accessory items before fabrication of the work proceeds.
- B. Submit shop drawings for the fabrication and installation of the doors and frames, and associated components. Details to be shown full scale. Include glazing details and finish hardware schedule. Indicate areas where door hardware shall be mounted for each door type.
- C. Samples: Submit manufacturer's standard colors chips for selection by architect. Color charts are not acceptable.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 - 1. Manufacturer is to have a minimum of ten years experience in the production of pre-assembled door, using materials specified for this project.
 - 2. Fiberglass doors shall be supplied by one door system manufacturer.
- B. Testing and Performance Requirements:

1. Provide door assemblies that have been designed and fabricated to comply with requirements for system performance characteristics listed below, as demonstrated by testing manufacturer's corresponding standard systems according to text methods designated.
 2. Thermal Transmission (exterior doors): "U" value of not more than 0.09 (STU/Hr.x sf x degrees F.) per AAMA 1503.01.
 3. Flame Spread/Smoke Developed: Provide FRP doors and panels with the following ratings in accordance with ASTM 84-79a;
 - a. Flame Spread: Not greater than 170 (Class C)
 - b. Smoke Developed: Not greater than 390 (Class C)
 4. Class A option for flame spread and smoke developed rating on interior faces of exterior panels and both faces of interior panel as shown. Flame spread no greater than 15. smoke developed no greater than 310 per ASTM #-84.
 5. Additional Criteria: Provide FRP doors and panels with the following performance:
 - a. ASTM D 256 nominal value of 20.0
 - b. ASTM D 570 nominal value of .20 to .40%
 - c. ASTM D 2583 nominal value of 50
- C. Regulation and Codes: Comply with the current edition in force at the project location of all local, state and federal codes and regulations, including the Americans with Disabilities Act.

1.5 WARRANTY

- A. Provide a written warranty signed by manufacturer, installer and contractor, agreeing to replace, at no cost to the Owner, any doors frames or factor hardware installation which fail in materials or workmanship, within the warranty period. Failure of materials or workmanship includes: excessive deflection, faulty operation of entrances, deterioration of finish or construction in excess of normal weathering is ten (10) years from acceptance.
- B. Provide a minimum one-year written warranty on all labor related to this section. Any workmanship that is defective or deficient shall be corrected to the Owner's satisfaction and at not additional cost to the owner.

PART 2 – PRODUCTS

2.1 MANUFACTURERS:

Doors shall as manufactured by Special-Lite, Inc. Request for substitutions will be accepted per section 00020.

2.2 MATERIALS AND ACCESSORIES

- A. Aluminum Member: Alloy and temper as recommended by manufacturer for strength, corrosion resistance and application of required finish and control of color; ASTM B 221 for extrusions, ASTM B 209 for sheet/plate with aluminum wall thickness of 0.125".
- B. Components: Furnish door and frame components from the same manufacturer. "Splitting" of door and frame components is not permitted.
- C. Fasteners: Aluminum, non-magnetic stainless steel or other noncorrosive metal fasteners, guaranteed by the manufacturer to be compatible with the doors, frames, stops, panels, hardware, anchors and other items being fastened. For exposed fasteners (if any) provide Phillips head screws with finish matching the item to be fastened.
- D. Glazing gaskets: For glazing factory-installed glass, and for gaskets which are factory-installed in "captive" assembly of glazing stops, manufacturer's standard stripping of molded neoprene, complying with ASTM D 2000 (designation 2BC415 to 3BC620), or molded PVC complying with ASTM C 509 Grade 4.

2.3 FABRICATION

- A. Sizes and Profiles: The required sizes for door and frame units, and profile requirements are shown on the drawings.

- B. Coordination of Fabrication: Field measure before fabrication, and show recorded measurements on final shop drawings.
- C. Complete the cutting, fitting, forming, drilling and grinding of all metal work prior to assembly. Remove burrs from cut edges, and ease edges and corners to a radius of approximately 1/64".
- D. No welding of door or frames is acceptable.
- E. Maintain continuity of line and accurate relation of planes and angles. Secure attachments and support at mechanical joints, with hairline fit at contacting members.

2.4 FIBERGLASS REINFORCED POLYESTER FRP FLUSH DOORS

NOTE: The Contractor shall coordinate and provide all reinforcing, concealed in the door, necessary for the support and installation of the door hardware specified in section 08710. All interior components must be coordinated not to interfere with the installation and function of door hardware.

A. Materials and Construction

- 1. Construct 1-3/4" thickness doors of 6063-T5 aluminum alloy rails and stiles minimum 2-5/16", depth. Construct with mitered corners and provide joinery of 3/8" diameter full width tie rods through extruded splines top and bottom as standard.
 - a. 1/8" tubular shaped stiles and rails reinforced to accept hardware as specified. Provide hex type aircraft nuts for joinery without welds, flues or other methods for securing internal door extrusions. Furnish integral reglets to accept face sheet to permit a flush appearance, Rail caps or other face sheet capture methods are not acceptable.
- 2. Extrude top and bottom rail lets for interlocking continuous rail rigidity weather bar. Lock face sheet material in place with extruded interlocking edges to be flush with aluminum rails and stiles.
- 3. Door face sheeting, 120" thickness fiberglass reinforced polyester. SL-17 doors with an abuse resistant engineered surface with color to match architect's custom color sample.
- 4. Core of Door Assembly: Minimum five (5) pounds per cubic foot density poured-in place polyurethane free of CFC. Minimum "R" value of 11. Ballistic rating is as indicated, Meeting stiles on pairs of doors and bottom weather bars with nylon brush weather-stripping.
- 5. Manufacture doors with Cutouts for vision lites, louvers or panels as scheduled. Factory furnish and install all glass, louvers and panels prior to shipment.
- 6. Pre-machine doors in accordance with templates from the specified hardware manufacturers and approved hardware schedule. Factory install hardware.

2.5 ALUMINUM FRAMING SYSTEMS

A. Insert Framing Systems

- 1. Model: SL-1031, SL-1032 or SL-1034
- 2. Insert frame as shown, using an integral stop fitted with weather-stripping.
- 3. Corner joints of miter design, secure with furnished aluminum clips, and screw into place.
- 4. Reinforce and pre-machine insert frame members for hardware in accordance with manufacturer's standards and the approved hardware schedule.
- 5. Anchors of a suitable type to fasten insert framing to existing frame materials, using a minimum of five anchors on jambs up to 7'-4" height, three on headers. One additional anchor for each additional lineal foot of frame.
- 6. Manufacturer shall provide four anchor holes located equidistant between the top and bottom slotted adjustment holes in the framing material.

2.6 GLAZING

A. Design system for replacement of glass.

- 1. Manufacturer's standard flush glazing system of recessed channels and captive glazing gaskets or applied stops as shown.
- 2. Allow for thermal expansion on exterior units.
- 3. Glass as shown and factory glazed into doors.

2.7 DOOR HARDWARE

- A. Hardware shall be as provided by Section 08710, door Hardware.
- B. Items of hardware affecting door preparation (hinges, lockset, exit devices, pulls) shall be sent to FRP door manufacturer for factory installation by the FRP door manufacturer.
- C. Factory installation of hardware shall be warranted for 10 years.

2.8 ALUMINUM FINISHES

- A. Anodized Surfaces: AAM12C22A31 Clear 204-R1.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS

- A. Installers shall be thoroughly trained and experienced in the skills required and shall be thoroughly familiar with the manufacturer's recommended methods of installation plus the requirements of this work.

3.2 INSTALLATION

- A. Field Measurement: Field verify all information prior to fabrication and furnishing of materials. Furnish and install materials omitted due to lack of verification at no additional cost to Owner.
- B. Comply with manufacturer's recommendations and specifications for the installation of the doors and frames. Factory install hardware, glass and louvers in doors.
- C. Set units plumb, level and true to line, without warp or rack of doors or frames. Anchor securely in place. Whenever aluminum is in contact with steel, concrete, or other materials potentially creative of the electrolytic action, provide all required permanent isolation of the aluminum by back painting with first-quality bituminous paint.
- D. All doors shall be installed complete with hardware, fittings and accessories. They shall be made to fit snugly without binding, to operate smoothly and to close without forcing.
- E. At completion o the building, all work shall be inspected. All movable and fixed parts, including hardware, shall be adjusted and put in proper operating condition. All damaged parts shall be repaired or replaced and the entire work left in perfect condition.
- F. No doors will be accepted where warp age is evident. No exterior door shall have a gap on the outside exceeding 1/16" or a gap on the inside exceeding 1/8 inch.
- G. Provide Owner with all adjustment tools and instruction sheets. Arrange an in-service session to owner at Owner's convenience.

3.3 CLEANING

- A. Clean surfaces promptly after installation of doors and frames, exercising care to avoid damage to the protective coatings.
- B. Ensure that the doors and frames will be without damage or deterioration (other than normal weathering) at the time of acceptance.
- C. Damaged work shall be replaced with new work. However, minor damage to metal incurred during erection, may be repaired if rating, strength and appearance of finish work are not impaired. Upon completion, metal surfaces shall be thoroughly cleaned.

END OF SECTION 08150

SECTION 08410 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes: Kawneer Architectural Aluminum Storefront Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront units.

- 1. Types of Kawneer Aluminum Storefront Systems include:

- a. Trifab® 451UT Storefront System – 2" x 4-1/2" (50.8 mm x 114.3 mm) nominal dimension; Thermal; Center Plane, Screw Spline Fabrication.

- B. Related Sections:

- 1. "Air Barriers" for materials used to bridge between aluminum storefront system and building intersection.
- 2. "Fire-Resistant Joint systems" for fire resistive material installed between aluminum storefront system and floor intersections.
- 3. "Joint Sealants" for joint sealants installed as part of the aluminum storefront system.
- 4. "Sloped Glazing Assemblies".

1.3 DEFINITIONS

- A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufacturers Association (AAMA) – AAMA Glossary (AAMA AG).

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Aluminum-framed storefront system shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

- 1. Design Wind Loads: Determine design wind loads applicable to the Project from basic wind speed indicated in miles per hour, according to ASCE 7, Section 6.5, "Method 2- Analytical Procedure," based on mean roof heights above grade indicated on Drawings. System must be designed to withstand windloads as determined by applicable local, state and federal building codes.

- B. Storefront System Performance Requirements:

1. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft^2 ($0.3 \text{ l/s} \cdot \text{m}^2$) at a static air pressure differential of 6.24 psf (300 Pa).
2. Water Resistance: The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a minimum static air pressure differential of 10 psf (479 Pa) as defined in AAMA 501.
3. Uniform Load: A static air design load of 30 psf (1436 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of $L/175$ of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.
4. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than:
 - a. $U = 0.60 \text{ BTU/hr/ft}^2/\text{°F}$.
5. Solar Heat Gain Coefficient (SHGC): Provide aluminum windows with a whole-window SHGC maximum of 0.30
5. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than:
 - a. 68_{frame} and 68_{glass} (low-e).
6. Condensation Resistance (I): When tested to CSA A-440, the condensation index shall not be less than:
 - a. 60_{frame} and 62_{glass} (low-e).
7. Sound Transmission Class (STC) and Outdoor-Indoor Transmission Class (OITC): When tested to AAMA Specification 1801 and in accordance with ASTM E1425 and ASTM E90, the STC and OITC Rating shall not be less than:
 - a. 37 (STC) and 30 (OITC).

1.5 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, hardware, finishes, and installation instructions for each type of aluminum frame storefront system indicated. Field verify each opening prior to fabrication.
- B. Shop Drawings: Include plans, elevations, sections, details, hardware, and attachments to other work, operational clearances and installation details.
- C. Samples for Initial Selection: For units with factory-applied color finishes including samples of hardware and accessories involving color selection.
- D. Samples for Verification: For aluminum framed storefront system and components required.

- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type of aluminum-framed storefront.
- F. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12" (300 mm) lengths of full-size components and showing details of the following:
 - 1. Joinery, including concealed welds.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.
- G. Other Action Submittals:
 - 1. Entrance Door Hardware Schedule: Coordinate door prep with hardware supplied by others.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.
- B. Manufacturer Qualifications: A manufacturer capable of providing aluminum framed storefront system that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.
- C. Source Limitations: Obtain aluminum framed storefront system through one source from a single manufacturer.
- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum framed storefront system and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements." Do not modify size and dimensional requirements.
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup for type(s) of storefront elevation(s) indicated, in location(s) shown on Drawings.
- F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination".

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of aluminum framed storefront openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

1.8 WARRANTY

- A. Manufactures Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.
 - 1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product:
 - 1. Kawneer Company Inc.
 - 2. Trifab® 451UT (thermal) Storefront System.
 - 3. Curtainwall system by same manufacturer.
 - 4. 2" x 4-1/2" (50.8 mm x 114.3 mm) System Dimensions
 - 5. Glass: Center Plane
- B. Substitutions:
 - 1. Product Literature and Drawings: Submit product literature and drawings modified to suit specific project requirements and job conditions.
 - 2. Certificates: Submit certificate(s) certifying substitute manufacturer (1) attesting to adherence to specification requirements for storefront system performance criteria, and (2) has been engaged in the design, manufacturer and fabrication of aluminum storefronts for a period of not less than ten (10) years. (Company Name)
 - 3. Test Reports: Submit test reports verifying compliance with each test requirement required by the project.
 - 4. Samples: Provide samples of typical product sections and finish samples in manufacturer's standard sizes.

2.2 MATERIALS

- A. Aluminum Extrusions: Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.
- B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim hardware, anchors, and other components.
- C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or

iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

- E. Sealant: For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.
- F. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

2.3 STOREFRONT FRAMING SYSTEM

- A. Thermal Barrier (Trifab[®] VG 451UT):
 - 1. Kawneer DUAL IsoLock[®] Thermal Break with two (2) 1/4" (6.4 mm) separations consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum storefront sections.
 - a. Thermal break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposed shall be stainless steel.
- D. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
- E. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- F. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront material against damage from elements, construction activities, and other hazards before, during and after storefront installation.

2.4 GLAZING SYSTEMS

- A. Glazing: All openings as specified in Division 08 Section "Glazing".
- B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.
- D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

- E. Glazing Sealants: As recommended by manufacturer for joint type.

2.5 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: AA 425 Wide Stile.
- B. Entrance Door Hardware: As specified in Division 08 Section "Door Hardware".

2.6 ACCESSORY MATERIALS

- A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants".
- B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30 mil (0.762 mm) thickness per coat.

2.7 FABRICATION

- A. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fit joints; make joints flush, hairline and weatherproof.
 - 3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
 - 4. Physical and thermal isolation of glazing from framing members.
 - 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 6. Provisions for field replacement of glazing.
 - 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- B. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- C. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
- D. Storefront Framing: Fabricate components for assembly using manufactures standard installation instructions.
- E. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing:

1. Kawneer Permafluo (70% PVDF), AAMA 2605, Fluoropolymer Coating. Architect to select from full range of colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather tight sliding door installation.
1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
 2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
 3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum framed storefront system, accessories, and other components.
- B. Install aluminum framed storefront system level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.
- D. Install aluminum framed storefront system and components to drain condensation, water penetrating joints, and moisture migrating within sliding door to the exterior.
- E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

- A. Field Tests: Architect shall select storefront units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present. Tests not meeting

specified performance requirements and units having deficiencies shall be corrected as part of the contract amount.

1. Testing: Testing shall be performed by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements. Testing Standard per AAMA 503, including reference to ASTM E 783 for Air Infiltration Test and ASTM E 1105 Water Infiltration Test.
 - a. Air Infiltration Tests: Conduct tests in accordance with ASTM E 783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft², whichever is greater.
 - b. Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 6.24 psf (300 Pa).
- B. Manufacturer's Field Services: Upon Owner's written request, provide periodic site visit by manufacturer's field service representative.

3.4 ADJUSTING, CLEANING, AND PROTECTION

- A. Clean aluminum surfaces immediately after installing aluminum framed storefronts. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 08410

SECTION 08710 – DOOR HARDWARE

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes furnishing and installation of door hardware for doors specified in “Hardware Sets” and required by actual conditions. Including screws, bolts, expansion shields, electrified door hardware, and other devices for proper application of hardware.
- B. Where items of hardware are not specified and are required for intended service, such omission, error or other discrepancy to be submitted to Architect fourteen calendar days prior to bid date for clarification by addendum.
- C. Products supplied but not installed under this Section:
 - 1. Hardware for aluminum doors will be furnished under this Section, but installed under Division 08 Openings
 - 2. Final replacement of cylinder cores to be installed by Owner.
 - 3. Electrified hardware will be furnished under this Section, but installed by the security contractor.
- D. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- E. Related Divisions:
 - 1. Division 08 Openings
 - 2. Division 26 Electrical
 - 3. Division 28 Electronic Safety And Security

1.02 REFERENCES

- A. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI):
 - 1. ANSI/BHMA A156.1 Butts & Hinges (2006)
 - 2. ANSI/BHMA A156.2 Bored & Preassembled Locks & Latches (2011)
 - 3. ANSI/BHMA A156.3 Exit Devices (2014)
 - 4. ANSI/BHMA A156.4 Door Controls – Closers (2008)
 - 5. ANSI/BHMA A156.5 Cylinders and Input Devices for Locks (2014)
 - 6. ANSI/BHMA A156.6 Architectural Door Trim (2010)
 - 7. ANSI/BHMA A156.7 Template Hinge Dimensions (2009)
 - 8. ANSI/BHMA A156.8 Door Controls – Overhead Stops and Holders (2010)
 - 9. ANSI/BHMA A156.16 Auxiliary Hardware (2008)
 - 10. ANSI/BHMA A156.18 Materials & Finishes (2006)
 - 11. ANSI/BHMA A156.21 Thresholds (2009)
 - 12. ANSI/BHMA A156.22 Door Gasketing Systems (2012)
 - 13. ANSI/BHMA A156.26 Continuous Hinges (2006)
 - 14. ANSI/BHMA A156.28 Keying Systems (2007)
 - 15. ANSI/BHMA A156.31 Electric Strikes (2007)
 - 16. ANSI/BHMA A156.115 Hardware Preparation in Steel Doors and Steel Frames (2014)
 - 17. ANSI/BHMA A156.115W Hardware Preparation in Wood Doors with Wood or Steel Frames (2006)
- B. International Code Council/American National Standards Institute (ICC/ANSI)/ADA:
 - 1. ICC/ANSI A117.1 Standards for Accessible and Usable Buildings and Facilities 2009
 - 2. Americans with Disabilities Act Accessibility Guidelines (ADAAG).
- C. Underwriters Laboratories, Inc. (UL):
 - 1. UL 10C Positive Pressure Fire Test of Door Assemblies
 - 2. UL 1784 Air Leakage Test of Door Assemblies
 - 3. UL/ULC Listed

- D. Door and Hardware Institute (DHI):
 - 1. DHI Publication – Keying Systems and Nomenclature (1989)
 - 2. DHI Publication – Abbreviations and Symbols
 - 3. DHI Publication – Installation Guide for Doors and Hardware
 - 4. DHI Publication – Sequence and Format of Hardware Schedule (1996)
- E. National Fire Protection Agency (NFPA)
 - 1. NFPA 70 National Electrical Code 2014
 - 2. NFPA 80 Standard for Fire Doors and Other Opening Protective's 2013
 - 3. NFPA 101 Life Safety Code 2015
 - 4. NFPA 105 Standard for the Installation of Smoke Door Assemblies 2013
- F. Building Codes
 - 1. IBC International Building Code 2015
 - 2. Local Building Code

1.03 SUBMITTALS

- A. Submit in accordance with Conditions of the Contract and Division 1 Administrative Requirements.
- B. Shop Drawings:
 - 1. Organize hardware schedule organized in vertical format illustrated in DHI Publications Sequence and Formatting for the Hardware Schedule. Include abbreviations and symbols page according to DHI Publications Abbreviations and Symbols. Complete nomenclature of items required for each door opening as indicated.
 - 2. Coordinate final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of hardware.
 - 3. Architectural Hardware Consultant (AHC), as certified by DHI, who shall affix seal attesting to completeness and correctness, shall review hardware schedule prior to submittal.
- C. Submit manufacturer's catalog sheet on design, grade and function of items listed in hardware schedule. Identify specific hardware item per sheet, provide index, and cover sheet.
- D. Coordination: Distribute door hardware templates to related divisions within fourteen days of receiving approved door hardware submittals.
- E. Electrified Hardware: Provide electrical information to include voltage, and amperage requirements for electrified door hardware and description of operation.
 - 1. Description of operation for each electrified opening to include description of component functions including location, sequence of operation and interface with other building control systems.
 - 2. Wiring Diagrams: Detail wiring for power, signal, and control system and differentiate between manufacturers installed and field installed wiring. Include the following:
 - a. System schematic
 - b. Point to point wiring diagram
 - c. Riser diagram
 - d. Elevation of each door
 - 3. Detail interface between electrified door hardware and fire alarm, access control, security, and building control systems.
 - 4. Provide junction boxes, relays and terminal blocks as needed for proper door operations and connections.
- F. Upon door hardware submittal approval, furnish for each electrified opening, three copies of point to point diagrams.

- G. Closeout Submittals: Submit to Owner in a three ringed binder or CD if requested.
 - 1. Warranties.
 - 2. Maintenance and operating manual.
 - 3. Maintenance service agreement.
 - 4. Record documents.
 - 5. Copy of approved hardware schedule.
 - 6. Copy of approved keying schedule with bitting list.
 - 7. Door hardware supplier name, phone number and fax number.

1.04 QUALITY ASSURANCE

- A. Listed and Labeled electrified door hardware as defined in NFPA 70, Article 100, by a testing agency acceptable to authority having jurisdiction.
- B. Hardware supplier shall employ an Architectural Hardware Consultant (AHC) as certified by DHI and a member of the seal program who shall be available at reasonable times during course of work for Project hardware consultation.
 - 1. Electrified Door Hardware Supplier Qualifications: Experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in service performance.
- C. Door hardware conforming to ICC/ANSI A117.1. : Handles, Pulls, Latches, Locks and operating devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
- D. Fire Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and or labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL 10C, unless otherwise indicated.
- E. Fire Door Inspection: Prior to receiving certificate of occupancy have fire rated doors inspected by an independent certified Fire and Egress Door Assembly Inspector (FDAI), as certified by Intertek (ITS), a written report shall be submitted to Owner and Contractor. Doors failing inspection shall be adjusted, replaced or modified to be within appropriate code requirements. Use for buildings under IBC 2009
- F. Smoke and Draft Control Door Assemblies: Where smoke and draft control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
- G. Door hardware certified to ANSI/BHMA standards as noted, participate and be listed in BHMA Certified Products Directory.
- H. Substitution request: Include the reason for requesting the substitution, clear catalog copy highlighting the proposed product and options, compliance statement, technical data, product warranty and lead time, to show how the proposed can meet or exceed established level of design function and quality. Approval of request is at the discretion of the owner, architect and their designated consultants.
- I. Pre-installation Meeting: Comply with requirements in Division 1 Section "Project Meetings."
 - 1. Convene meeting seven days before installation. Participants required to attend: Contractor, installer, material supplier, manufacturer representatives, electrical contractor, security consultant and fire alarm consultant.
 - 2. Include in conference decisions regarding proper installation methods and procedures for receiving and handling hardware.
 - 3. Review sequence of operation for each type of electrified door hardware, inspect, and discuss electrical roughing-in and other preparatory work performed by other trades.
 - 4. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
- J. Within fourteen days of receipt of approved door hardware submittals contact Owner with representative from hardware supplier to establish a keying conference. Verify keyway, visual key identification, number of master keys and keys per lock. Provide keying system per Owners instructions.

- K. Installer Qualifications: Specialized in performing installation of this Section and have five years minimum documented experience.
- L. Hardware listed in 3.07- Hardware Schedule is intended to establish type and grade.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Provide clean, dry and secure room for hardware delivered to Project but not yet installed.
- B. Furnish hardware with each unit marked and numbered in accordance with approved finish hardware schedule. Include door and item number for each type of hardware.
- C. Pack each item complete with necessary parts and fasteners in manufacturer's original packaging.
- D. Deliver permanent key, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to Owner shall be established at "Keying Conference."
- E. Waste Management and Disposal: Separate waste materials for reuse or recycling in accordance with Division 1.

1.06 WARRANTY

- A. General Warranty: Owner may have under provisions of the Contract Documents and be an addition and run concurrent with other warranties made by Contractor under requirements of the Contract documents.
- B. Special Warranty: Warranties specified in this article shall not deprive Owner of other rights. .
 - 1. Ten years for manual door closers.
 - 2. Five years for mortise, auxiliary and bored locks.
 - 3. Five years for exit devices.
 - 4. One year for electromechanical door hardware.
- C. Replace or repair defective products during warranty period in accordance with manufacturer's warranty at no cost to Owner. There is no warranty against defects due to improper installation, abuse and failure to exercise normal maintenance.
- D. Maintenance Tool and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, removal and replacement of door hardware.

PART 2 – PRODUCTS

2.01 CONTINUOUS HINGES

- A. Continuous hinges of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Standards: Products to be certified and listed by the following: Continuous Hinges: ANSI/BHMA A156.26 Grade 1
- C. Continuous Geared Hinges:
 - 1. Determine model number by door and frame application, door thickness, frequency of use, and fire rating requirements according to manufacturer's recommendations.
 - a. Length of hinge shall be 1" less door height unless otherwise stated in hardware sets.
- D. Material and Design:
 - 1. Base material: Anodized aluminum manufactured from 6063-T6 material, unexposed working metal surfaces shall be coated with TFE dry lubricant
 - 2. Bearings:
 - a. Vertical loads shall be carried on Lubriloy RL bearings for non Fire Rated doors.

- b. Continuous hinges shall have a minimum spacing between bearings of 2-9/16". Typical door from 80" to 84" in height to have a minimum of 32 bearings.
- 3. Options:
 - a. When full width of opening is required, use hinges that are designed to swing door completely from opening when door is opened to 95 degrees.
 - b. Fire rated hinges shall carry UL certification, up to and including 90-minute applications for wood doors and up to 3-hour applications for metal doors.

E. Acceptable Manufacturers:

- | | |
|--------------------|------------|
| | Heavy Duty |
| 1. Hager Companies | 780-112HD |
| 2. Bommer | FMSLFHD |
| 3. Zero | 910A |

2.02 LOCKS AND LATCHES

- A. Locks and latches of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Standards: Product to be certified and listed by following:
 - 1. ANSI/BHMA A156.2 Series 4000 Certified to Grade 1.
 - 2. ANSI/BHMA A250.13 Certified for a minimum design load of 1150lbf (100psf) for single out swinging doors measuring 36" in width and 84" in height and a minimum design load of 1150lbf (70psf) for out swinging single doors measuring 48" in width and 84" in height.
 - 3. UL/cUL Labeled and listed for functions up to 3 hours for single doors up to 48" in width and up to 96" in height.
 - 4. UL10C/UBC 7-2 Positive Pressure Rated.
 - 5. ICC/ANSI A117.1.
- C. Lock and latch function numbers and descriptions of manufactures series as listed in hardware sets.
- D. Material and Design:
 - 1. Lock and Latch chassis to be Zinc dichromate for corrosion resistance.
 - 2. Keyed functions to be of a freewheeling design to help resists against vandalism.
 - 3. Non-handed, field reversible.
 - 4. Thru-bolt mounting with no exposed screws.
 - 5. Levers, Zinc cast and plated to match finish designation in hardware sets.
 - 6. Roses, wrought Brass or Stainless Steel material.
- E. Latch and Strike:
 - 1. Stainless Steel latch bolt with minimum of 1/2" throw and deadlocking for keyed and exterior functions. Provide 3/4" latchbolt for pairs of fire rated doors where required by door manufacture. Standard backset to be 2-3/4" and adjustable faceplate to accommodate a square edge door or a standard 1/8" beveled edge door.
 - 2. Strike is to fit a standard ANSI A115 prep measuring 1-1/4" x 4-7/8" with proper lip length to protect surrounding trim.
- F. Acceptable Manufacturers:
 - 1. Best Lock: 9K Series No Substitution.

2.03 EXIT DEVICES

- A. Exit Devices of one manufacturer as listed for continuity of design and consideration of warranty. Touch pad type, finish to match balance of door hardware
- B. Standards: Manufacturer to be certified and or listed by the following:
 - 1. BHMA Certified ANSI A156.3 Grade 1
 - 2. UL/cUL Listed for up to 3 hours for "A" labeled doors
 - 3. UL10C/UBC 7-2 Positive Pressure Rated

4. UL10B Neutral Pressure Rated
5. UL 305 Listed for Panic Hardware

C. Material and Design:

1. Touch pad shall extend a minimum of one half-door width. Freewheeling lever design shall match design of locks levers. Exit device to mount flush with door.
2. Latchbolts:
 - a. Rim device – ¾” throw, Pullman type with automatic dead-latching, stainless steel
 - b. Surface vertical rod device – Top ½” throw, Pullman type with automatic dead-latching, stainless steel. Bottom ½” throw, Pullman type, held retracted during door swing, stainless steel.
3. Fasteners: Wood screws, machine screws and thru-bolts.

D. Lock and Latch Functions: Function numbers and descriptions of manufacturer's series and lever styles indicated in door hardware sets.

E. Acceptable Manufacturers:

1. Von Duprin: 99 Series No Substitution.

2.04 CYLINDERS AND KEYING

A. Cylinders of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer shall meet the following:

1. Auxiliary Locks: ANSI/BHMA A156.5
2. DHI Handbook “Keying systems and nomenclature” (1989)

C. Cylinders:

1. Manufacturer's standard tumbler type, six or seven-pin IC core.
2. Furnish with cams/tailpieces as required for locking device that is being furnished for project.

D. Keying:

1. Copy of Owners approved keying schedule submitted to Owner and Architect with documentation of which keying conference was held and Owners sign-off.
2. Provide a bitting list to Owner of combinations as established, and expand to twenty five percent for future use or as directed by Owner.
3. Key into Owner's existing keying system.
4. Keys to be shipped to Owner's representative, individually tag per keying conference.
5. Provide visual key control identification on keys.
6. Provide interchangeable cores with construction cores as required per hardware schedule.
7. Provide two (2) control keys.

E. Acceptable manufacturers:

1. Best Lock No Substitution.

2.05 CLOSERS

A. Closers of one manufacturer as listed for continuity of design and consideration of warranty. Unless otherwise indicated on hardware schedule, comply with manufacturer's recommendation for size of closer, depending on width of door, frequency of use, atmospheric pressure, ADAAG requirements, and fire rating.

B. Standards: Manufacturer to be certified and or listed by the following:

1. BHMA Certified ANSI A156.4 Grade 1
2. ADA Compliant ANSI A117.1
3. UL/cUL Listed up to 3 hours.
4. UL10C Positive Pressure Rated
5. UL10B Neutral Pressure Rated

- C. Material and Design:
1. Provide cast iron non-handed bodies with full plastic covers.
 2. Closers shall have separate staked adjustable valve screws for latch speed, sweep speed, and backcheck.
 3. Provide Tri-Pack arms and brackets for regular arm, top jamb, and parallel arm mounting.
 4. One-piece seamless steel spring tube sealed in hydraulic fluid.
 5. Double heat-treated steel tempered springs.
 6. Precision-machined heat-treated steel piston.
 7. Triple heat-treated steel spindle.
 8. Full rack and pinion operation.
- D. Mounting:
1. Out swing doors use surface parallel arm mount closers except where noted on hardware schedule.
 2. In swing doors use surface regular arm mount closers except where noted on hardware schedule.
 3. Provide brackets and shoe supports for aluminum doors and frames to mount fifth screw.
 4. Furnish drop plates where top rail conditions on door do not allow for mounting of closer and where backside of closer is exposed through glass.
- E. Size closers in compliance with requirements for accessibility (ADDAG). Comply with following maximum opening force requirements.
1. Interior hinged openings: 5.0 lbs.
 2. Fire rated and exterior openings use minimum opening force allowable by authority having jurisdiction.
- F. Fasteners: Provide self-reaming and self-tapping wood and machine screws and sex nuts and bolts for each closer.
- G. Acceptable manufacturers:
1. Hager Companies: 5100 Series
 2. LCN: 4040XP Series
 3. Sargent: 281 Series

2.06 PROTECTIVE TRIM

- A. Protective trim of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Size of protection plate: Single doors, size two inches less door width (LDW) on push side of door, and one inch less on pull side of door. For pairs of doors, size one inch less door width (LDW) on push side of door, and ½ inch on pull side of door.
1. Kickplates 10" high or sized to door bottom rail height
- C. Standards: Manufacturer shall meet requirements for:
1. Architectural Door Trim: ANSI/BHMA A156.6
 2. UL
- D. Material and Design:
1. 0.050" gage stainless steel
 2. Corners square, polishing lines or dominant direction of surface pattern shall run across door width of plate.
 3. Bevel top, bottom and sides uniformly leaving no sharp edges.
 4. Countersink holes for screws. Screws holes shall be spaced equidistant eight inches CTC, along a centerline not over ½ inch in from edge around plate. End screws maximum of 0.53 inch from corners.
- E. UL label stamp required on protection plates when top of plate is more than 16 inches above bottom of door on fire rated openings. Verify door manufactures UL listing for maximum height and width of protection plate to be used.
- F. Acceptable Manufacturers:
1. Hager Companies: 194S
 2. Trimco

3. Burns

2.07 STOPS AND HOLDERS

- A. Stops and holders of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Wall Stops: Provide door stops wherever necessary to prevent door or hardware from striking an adjacent partition or obstruction. Provide wall stops when possible. Door stops and holders mounted in concrete floor or masonry walls have stainless steel machine screws and lead expansion shields.
- C. Standards: Manufacturer shall meet requirements for:
 1. Auxiliary Hardware: ANSI/BHMA A156.16
- D. Acceptable Manufacturers:

	Convex	Concave
1. Hager Companies:	232W	236W
2. Rockwood:		
3. Burns:		
- E. Overhead Stops and Holders: Provide overhead stop and holders for doors that open against equipment, casework sidelights and other objects that would make wall stops/holders and floor stops/holders inappropriate. Provide sex bolt attachments for mineral core wood door applications.
- F. Standards: Manufacturer shall be certified by the following:
 1. Overhead Stops and Holders: ANSI/BHMA A156.8 Grade 1
- G. Acceptable Manufacturers:

	Heavy Duty Concealed
1. Hager Companies:	7000 CON Series
2. Glynn Johnson:	100 Series
3. Sargent:	690 Series

2.08 THRESHOLDS

- A. Thresholds of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Set thresholds for exterior and acoustical openings in full bed of sealant with lead expansion shields and stainless steel machine screws complying with requirements specified in Division 7 Section "Joint Sealants". Notched in field to fit frame by hardware installer. Refer to Drawings for special details.
- C. Standards: Manufacturer to be certified by the following:
 1. Thresholds: ANSI/BHMA A156.21
 2. Americans with Disabilities Act Accessibility Guidelines (ADAAG).
- D. Acceptable Manufacturers:
 1. Hager Companies: 412S
 2. K.N. Crowder
 3. Reese

2.09 DOOR GASKETING AND WEATHERSTRIP

- A. Door gasketing and weatherstrip of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing where indicated on hardware schedule. Provide non-corrosive fasteners for exterior applications.
 1. Perimeter gasketing: Apply to head and jamb, forming seal between door and frame.

2. Meeting stile gasketing: Fasten to meeting stiles, forming seal when doors are in closed position.
 3. Door bottoms: Apply to bottom of door, forming seal with threshold or floor when door is in closed position.
 4. Sound Gasketing: Cutting or notching for stop mounted hardware not permitted.
 5. Drip Guard: Apply to exterior face of frame header. Lip length to extend 4" beyond width of door.
- C. Standards: Manufacturer shall meet requirements for:
1. Door Gasketing and Edge Seal Systems: ANSI/BHMA A156.22
 2. BHMA certified for door sweeps, automatic door bottoms, and adhesive applied gasketing. (721)
- D. Smoke-Labeled Gasketing: Comply with NFPA 105 listed, labeled, and acceptable to authorities having jurisdiction, for smoke control indicated.
1. Provide smoke labeled gasketing on 20 minute rated doors and on smoke rated doors.
- E. Fire-Rated Gasketing: Comply with NFPA 80 listed, labeled, and acceptable to Authorities Having Jurisdiction, for fire ratings indicated.
- F. Refer to Section 08 1416 Wood Doors for Category A or Category B. Comply with UBC 7-2 and UL10C positive pressure where frame applied intumescent seals are required. Provide Hager # 720 for single and 720 x 724 for a pair of doors.
- G. Acceptable Manufacturers:
1. Perimeter Gasketing:

	Adhesive Applied
a. Hager Companies:	726
b. K.N. Crowder:	
c. Reese:	
 2. Meeting Stile Weatherstrip:

a. Hager Companies:	802SB
b. K.N. Crowder:	
c. Reese:	
 3. Door Bottom Sweeps:

a. Hager Companies:	750SN
b. K.N. Crowder:	
c. Reese:	

2.10 SILENCERS

- A. Where smoke, light, or weather seal are not required, provide three silencers per single door frame, two per double door frame and four per Dutch door frame.
- B. Standards: Manufacturer shall meet requirements for:
1. Auxiliary Hardware: ANSI/BHMA A156.16
- C. Acceptable Manufacturers:
- | | |
|---------------------|--------------------|
| | Hollow Metal Frame |
| 1. Hager Companies: | 307D |
| 2. Rockwood: | |
| 3. Trimco: | |

2.11 FINISHES

- A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if within range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples.

- B. Comply with base material and finish requirements indicated by ANSI/BHMA A156.18 designations in hardware schedule.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install hardware per manufacturer's instructions and in compliance with:
1. NFPA 80.
 2. NFPA 105.
 3. ICC/ANSI A117.1.
 4. ANSI/BHMA A156.115 Hardware Preparation in Steel Doors and Steel Frames
 5. ANSI/BHMA A156.115W Hardware Preparation in Wood Doors with Wood or Steel Frames
 6. DHI Publication – Installation Guide for Doors and Hardware
 7. UL10C/UBC7-2
 8. Local building code.
 9. Approved shop drawings.
 10. Approved finish hardware schedule.
- B. Do not install surface mounted items until finishes have been completed on substrates involved. Set unit level, plumb and true to line location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

3.03 FIELD QUALITY CONTROL

- A. Material supplier to schedule final walk through to inspect hardware installation ten business days before final acceptance of Owner. Material supplier shall provide a written report detailing discrepancies of each opening to General Contractor within seven calendar days of walk through.

3.04 ADJUSTMENT, CLEANING AND DEMONSTRATING

- A. Adjustment: Adjust and check each opening to ensure proper operation of each item of finish hardware. Replace items that cannot be adjusted to operate freely and smoothly or as intended for application at no cost to Owner.
- B. Cleaning: Clean adjacent surfaces soiled by hardware installation. Clean finished hardware per manufacturer's instructions after final adjustments has been made. Replace items that cannot be cleaned to manufacturer's level of finish quality at no cost to Owner.
- C. Demonstration: Conduct a training class for building maintenance personnel demonstrating the adjustment, operation of mechanical and electrical hardware. Special tools for finished hardware to be turned over and explained usage at this meeting.

3.05 PROTECTION

- A. Leave manufacturer's protective film intact and provide proper protection for all other finish hardware items that do not have protective material from the manufacture until Owner accepts Project as complete.

3.06 HARDWARE SET SCHEDULE

- A. Guide: Door hardware items have been placed in sets which are intended to be a guide of design, grade, quality, function, operation, performance, exposure, and like characteristics of door hardware, and may not be complete. Provide door hardware required to make each set complete and operational.
- B. Hardware schedule does not reflect handing, backset, method of fastening and like characteristics of door hardware and door operation.
- C. Review door hardware sets with door types, frames, sizes and details on drawings. Verify suitability and adaptability of items specified in relation to details and surrounding conditions.

3.07 HARDWARE SCHEDULE

SET #01

Provide for each Door

1 Continuous Hinge	780-112HD 83"	CLR	HA
1 Exit Device	99NL x 990NL-R&V	US26D	VO
1 Rim Cylinder	12E-72 STD	626	BE
1 Closer	5100 5955-HDCS	ALM	HA
1 Blade Stop Spacer	5113	ALM	HA
1 Heavy Duty Arm Bracket	5111	ALM	HA
1 Threshold	412S 36"	MIL	HA
1 Door Bottom Sweep	750S N 36"	CLR	HA

NOTE: Provide Weatherstripping.

END OF SECTION

SECTION 08800 – GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Furnish all labor materials, tools, equipment, and services for Glazing. Provide all miscellaneous items, appurtenances and devices, incidental to or necessary for a sound, secure and complete installation.

1.2 SUMMARY

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Windows.
 - 2. Doors.
 - 3. Glazed entrances.
 - 4. Interior borrowed lites.

1.3 DEFINITIONS

- A. Manufacturer: A firm that produces primary glass or fabricated glass as defined in referenced glazing publications.
- B. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- C. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass

framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass and of 12-inch- (300-mm-) long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- C. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- E. Product Data: For each glass product and glazing material indicated.

LEED Submittals:

1. Product Data for Credit IEQ 4.1: For glazing sealants used inside the weatherproofing system, documentation including printed statement of VOC content.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Source Limitations for Glass: Obtain clear float glass from one primary-glass manufacturer.
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
- D. Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.
- E. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
- F. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following inspecting and testing agency:

1. Insulating Glass Certification Council.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F (4.4 deg C).

1.9 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Manufacturer's Special Warranty on Insulating Glass: Written warranty, made out to Owner and signed by insulating-glass manufacturer agreeing to furnish replacements for insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

Note: Provide safty glass in all areas where required by code.

2.1 PRODUCTS AND MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in schedules at the end of Part 3.
- B. Products: Subject to compliance with requirements, provide one of the products indicated in schedules at the end of Part 3.

2.2 PRIMARY FLOAT GLASS

- A. Float Glass: ASTM C 1036, Type I (transparent glass, flat), Quality q3 (glazing select); class as indicated in schedules at the end of Part 3.

2.3 HEAT-TREATED FLOAT GLASS

- A. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent glass, flat); Quality q3 (glazing select); class, kind, and condition as indicated in schedules at the end of Part 3.

2.4 WIRED GLASS

- A. Wired Glass: ASTM C 1036, Type II (patterned and wired glass, flat), Class 1 (clear), Quality q8 (glazing); 6.4 mm thick; of form and mesh pattern indicated below:
 - 1. Polished Wired Glass: Form 1 (wired, polished both sides), and as follows:
 - a. Mesh m1 (diamond).
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Polished Wired Glass:
 - a. Ashai Glass Co./Ama Glass Corp.
 - b. Central Glass Co., Ltd.
 - c. Nippon Sheet Glass Co., Ltd.
 - d. Pilkington Glass Ltd.

2.5 INSULATING GLASS

- A. Insulating-Glass Units: Preassembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in the Insulating-Glass Schedule at the end of Part 3.
- B. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated in the Insulating-Glass Schedule are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
- C. Sealing System: Dual seal, with primary and secondary sealants as follows:
 - 1. Manufacturer's standard sealants meeting requirements of LEED IEQ 4.1.
- D. Spacer Specifications: Manufacturer's standard spacer material and construction.

- E. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:

- 1. Corner Construction: Manufacturer's standard corner construction.

2.6 GLAZING GASKETS

- A. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C 542, black.

- B. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

- 1. Neoprene, ASTM C 864.
 - 2. EPDM, ASTM C 864.
 - 3. Silicone, ASTM C 1115.
 - 4. Thermoplastic polyolefin rubber, ASTM C 1115.
 - 5. Any material indicated above.

- C. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:

- 1. Neoprene.
 - 2. EPDM.
 - 3. Silicone.
 - 4. Thermoplastic polyolefin rubber.
 - 5. Any material indicated above.

2.7 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

- C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.

- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

- F. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.8 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.
- B. Grind smooth and polish exposed glass edges.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing glazing, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep system.
 - 3. Minimum required face or edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where the length plus width is larger than 50 inches (1270 mm) as follows:
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. It shall be the responsibility of the Contractor to provide tempered "Safety Glass" as required by Code.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until just before each glazing unit is installed.
- F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 PROTECTION AND CLEANING

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

3.8 GLAZING SCHEDULE:

NOTE: All glazing thicknesses must be designed to resist wind loads for the project area. The following should be considered a minimum:

<u>Location</u>	<u>Thickness</u>
Interior	¼" Provide safety glass as required by code
Exterior Glazing 1	PPG Solarban z75 (2) with Clear Glass on one lite.

- A. Type: Exterior Glazing - Low-E Tinted Insulating Glass, low-reflective glass outdoor appearance.
1. Product: "Solarban" z75 (2) + Clear by PPG Industries, Inc.
 2. Insulating Unit Construction: 1/4 inch "Solarban" z75 Solar Control (Sputtered) on second surface (2), + 1/2 inch (13mm) air space + 1/4 inch (6mm) Clear Float Glass.
 3. Performance Values: Visible Light Transmission – 48 percent; SHGC – 0.24; Shading Coefficient – 0.28; Outdoor Visible Light Reflectance – 9 percent.

END OF SECTION 08800

SECTION 09250 – EXTERIOR SHEATHING

PART 1 – GENERAL

1.1 DESCRIPTION:

A. Work in this section includes, but is not limited to: exterior wall sheathing.

1. Related work specified elsewhere:

- a. Cold formed metal framing.
- b. Rough carpentry.
- c. Joint sealers.
- d. Light-gauge metal framing.
- e. Architectural wall panels.

1.2 SUBMITTALS:

A. Product data: Submit manufacturer's descriptive literature indicating material composition, thickness, sizes and fire resistance.

1.3 QUALITY ASSURANCE:

A. Fire-resistance ratings: Where applicable, provide materials and construction that are identical to those of assemblies whose fire-resistance ratings are indicated.

1.4 DELIVERY, STORAGE AND HANDLING:

- A. Delivery: Deliver materials to the job site in manufacturer's original packaging, containers and bundles with manufacturer's brand name and identification intact and legible.
- B. Storage and handling: Store and handle materials to protect against contact with damp and wet surfaces, exposure to weather, breakage and damage to edges. Provide air circulation under covering and around stacks of materials.

1.5 LIMITATIONS:

- A. For all installations, design details such as fasteners, sealants and control joints per system specifications must be properly installed. Openings and penetrations must be properly flashed and sealed.
- B. Do not use DensGlass Gold sheathing as a base for nailing or mechanical fastening. Fasteners should be flush to the face of the board, not countersunk.

PART 2 – PRODUCTS

2.1 SHEATHING BOARD:

A. Acceptable Products:

1. ½" DensGlass Gold Exterior Sheathing or preapproved equals.

B. Composition:

1. Gypsum sheathing manufactured in accordance with ASTM C 1177 with glass mats both sides and long edges, water-resistant treated core.

C. Fire resistance:

1. ½" DensGlass Gold Exterior Sheathing: Flame spread 10, smoke developed 0, when tested in accordance with ASTM E 84.

2.2 AIR, WATER AND WEATHER BARRIER:

- A. Tape all joints and apply water-resistive membrane and air barrier to entire exterior side of sheathing. See section 07240.

2.3 ACCESSORIES:

- A. Joint tape: 2" wide 10x10 glass mesh tape.
- B. Screws, metal framing:
 1. Bugle or wafer head, self-tapping, rust-resistant, fine thread for heavy-steel gauge.
 2. Bugle or wafer head, rust-resistant sharp point, fine thread for light-gauge metal framing or furring.

PART 3 – EXECUTION

3.1 PREPARTION:

- A. Examine subframing; verify that surface of framing and furring members to receive sheathing does not vary more than 1/8" from the placement of faces of adjacent members.

3.2 SHEATHING:

- A. Provide DensGlass Gold Exterior Sheathing where indicated on drawings. Install sheathing in accordance with manufacturer's instructions and applicable instructions in GA-253 and ASTM C 1280.
- B. Install DensGlass Gold Exterior Sheathing with gold side out.
- C. Use maximum lengths possible to minimize number of joints.
- D. Attach DensGlass Gold Exterior Sheathing to metal framing with screws spaced 8" o.c. at perimeter where there are framing supports; and 8" o.c. along intermediate framing in field.
- E. Drive fasteners to bear tight against and flush with surface of sheathing. Do not counter sink.
- F. Locate fasteners minimum 3/8" from edges and ends of sheathing panels, tight against and flush with surface of sheathing.

END OF SECTION

SECTION 09255 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Gypsum board assemblies.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section 5400 Cold Formed Metal Framing
 - 1. Section 06100 Rough Carpentry

1.3 DEFINITIONS

- A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 ASSEMBLY PERFORMANCE REQUIREMENTS

- A. Fire Resistance: Provide gypsum board assemblies with fire-resistance ratings indicated.

1.5 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each type of product specified.
- C. Proposed control joint layout.

1.6 QUALITY ASSURANCE

- A. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.
- B. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

- C. Fire-Test-Response Characteristics: Where fire-resistance-rated gypsum board assemblies are indicated, provide gypsum board assemblies that comply with the following requirements:
 - 1. Fire-Resistance Ratings: As indicated by GA File Numbers in GA-600 "Fire Resistance Design Manual" or design designations in UL "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 2. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

1.7 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 panels flat to prevent sagging.

1.8 PROJECT CONDITIONS

- A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 requirements or gypsum board manufacturer's recommendations, whichever are more stringent.
- B. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F (10 deg C) for 48 hours before application and continuously after until dry. Do not exceed 95 deg F (35 deg C) when using temporary heat sources.
- C. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Gypsum Board and Related Products:
 - a. Georgia-Pacific Corp.
 - b. National Gypsum Co.; Gold Bond Building Products Division.
 - c. United States Gypsum Co.

2.2 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 (1219 mm).
- B. Gypsum Wallboard:
 - 1. Type: Interior -. Thickness: 5/8 inch (15.9 mm).
 - 2. Type: Type X where required for fire-resistance-rated assemblies.
 - 3. Exterior: See 09250 – Exterior Sheathing.
 - 4. Edges: Tapered and featured (rounded or beveled) for prefilling.
- C. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M and as follows:
 - 1. Type: Regular, unless otherwise indicated.

2.3 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 complying with the following requirement:
 - a. Steel sheet zinc coated by hot-dip process or rolled zinc.
 - b. Steel sheet zinc coated by hot-dip or electrolytic process, or steel sheet coated with aluminum or rolled zinc.
 - 2. Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047:
 - a. Cornerbead on outside corners.
 - b. LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim, unless otherwise indicated.
 - c. L-bead with face flange only; face flange formed to receive joint compound. Use L-bead where indicated.
 - d. U-bead with face and back flanges; face flange formed to be left without application of joint compound. Use U-bead where indicated.
 - e. One-piece control joint formed with V-shaped slot and removable strip covering slot opening spaced no more than 20'-0" o.c. Provide layout for approval prior to installation.
- B. Accessory for Curved Edges: Cornerbead formed of metal, plastic, or metal combined with plastic, with either notched or flexible flanges that are bendable to curvature radius.
- C. Finished accessories – metal corner guards. Install at all exposed outside corners. Leg length 1". Min 6'-0" in height.

2.4 JOINT TREATMENT MATERIALS

- A. General: Provide joint treatment materials complying with ASTM C 475/C 475M 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.

- C. Setting-Type Joint Compounds for Gypsum Board: Factory-packaged, 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.
 - 3. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by gypsum board manufacturer.
 - 4. For topping compound, use sandable formulation.

2.5 MISCELLANEOUS MATERIALS

- A. General: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Steel drill screws complying with ASTM C 1002 for the following applications:
 - 1. Fastening gypsum board to wood members.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 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.
- 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 (1.5 mm) of open space between panels. 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 on opposite sides of partitions. Avoid joints other than control joints at corners of framed openings where possible.

- F. Attach gypsum panels to framing provided at openings and cutouts.

3.3 GYPSUM BOARD APPLICATION METHODS

- A. Single-Layer Application: Install gypsum wallboard panels as follows:
 - 1. On ceilings, apply gypsum panels prior to wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated, and provide panel lengths that will minimize end joints.
- B. Wall Tile Substrates: For substrates indicated to receive thin-set ceramic tile and similar rigid applied wall finishes, comply with the following:
 - 1. Install water-resistant gypsum backing board panels at showers, tubs, and where indicated. Install with 1/4-inch (6.4-mm) open space where panels abut other construction or penetrations.
- C. Single-Layer Fastening Methods: Apply gypsum panels to supports as follows:
 - 1. Fasten to wood supports with adhesive and supplementary nails or screws.

3.4 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 cornerbead at external corners.

3.5 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, flanges of cornerbead, 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 1 for ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
 - 2. Level 2 where panels form substrates for tile.
 - 3. Level 3 for gypsum board where indicated. (Ceilings)
 - 4. Level 5 for gypsum board surfaces. (Walls)
- E. Use the following joint compound combination as applicable to the finish levels specified:
 - 1. Embedding and First Coat: Setting-type joint compound. Fill (Second) Coat: Setting-type joint compound. Finish (Third) Coat: Sandable, setting-type joint compound.

- F. Where Level 5 gypsum board finish is indicated, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories; and apply a thin, uniform skim coat of joint compound over entire surface. For skim coat, use joint compound specified for third coat, or a product specially formulated for this purpose and acceptable to gypsum board manufacturer. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects, tool marks, and ridges and ready for decoration.
- G. Where Level 3 gypsum board finish is indicated, embed tape in joint compound and apply first and fill (second) coats of joint compound.
- H. Where Level 2 gypsum board finish is indicated, embed tape in joint compound and apply first coat of joint compound.
- I. Where Level 1 gypsum board finish is indicated, embed tape in joint compound.
- J. Finish water-resistant gypsum backing board forming base for ceramic tile to comply with ASTM C 840 and gypsum board manufacturer's directions for treatment of joints behind tile.
- K. Finish cementitious backer units to comply with unit manufacturer's directions.

3.6 FIELD QUALITY CONTROL

- A. Above-Ceiling Observation: Architect will conduct an above-ceiling observation prior to installation of gypsum board ceilings and report any deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

3.7 CLEANING AND PROTECTION

- A. Promptly remove any residual joint compound from adjacent surfaces.
- B. Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure gypsum board assemblies are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 09255

SECTION 09900 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation, painting, and finishing of exposed interior and exterior items and surfaces.
 - 1. Surface preparation, priming, and finish coats specified in this section are in addition to shop priming and surface treatment specified under other sections.
- B. Paint exposed surfaces whether or not spaces are designated in "schedules", except where a surface or material is specifically indicated not to be painted or is to remain natural or factory finished. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.
 - 1. Painting includes field painting exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- C. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces except as indicated, operating parts, and labels.
 - 1. Concealed Gypsum Drywall: Provide scheduled moisture retarding primer finish at all concealed gypsum drywall located above acoustical panel ceilings.
 - 2. Labels: Do not paint over UL, FM, or other code required labels or equipment name, identification, performance rating, or nomenclature plates.
- D. Related Sections: The following sections contain requirements that relate to this Section:
 - 1. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
 - 2. Division 8 Section "Steel Doors and Frames" for shop priming steel doors and frames.

1.2 DEFINITIONS

- A. "Paint" includes coating systems materials, primers, emulsions, enamels, stains, sealers, and fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's technical information, label analysis, and application instructions for each material proposed for use.
 - 1. List each material and cross-reference the specific coating and finish system and application. Identify each material by the manufacturer's catalog number and general classification.
- B. Samples for initial color selection in the form of manufacturer's color charts.
 - 1. After color selection, the Architect will furnish color chips for surfaces to be coated.

- C. Samples for Verification Purposes: Provide samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate. Define each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
 - 1. Provide a list of material and application for each coat of each sample. Label each sample as to location and application.
 - 2. Submit samples on the following substrates for the Architect's review of color and texture only:
 - a. Concrete Masonry: Provide two 4 - by 8 - inch samples of masonry, with mortar joint in the center, for each finish and color.
 - b. Gypsum Board: Provide two 12 - by 12 - inch samples of each finish and color on gypsum board.
 - c. Ferrous Metal: Provide two 4 - by 8 - inch samples of flat metal for each finish and color.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.
- B. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify the Architect of problems anticipated using the materials specified.
- C. Material Quality: Provide the manufacturer's best quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.
 - 1. Proprietary names used to designate colors or materials are not intended to imply that products names are required or to exclude equal products of other manufacturers.
- D. Field Constructed Mock-Ups: Apply primer and each coat of paint to one typical classroom. Classroom shall be reviewed and approved by the Owner and Architect prior to the application to any other paint. The mock-up classroom shall serve as the standard for all CMU paint application throughout the building.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the job site in the 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. Federal Specification number, if applicable.
 - 4. Manufacturer's stock number and date of manufacture.
 - 5. Contents by volume, for pigment and vehicle constituents.
 - 6. Thinning instructions.
 - 7. Application instructions.
 - 8. Color name and number.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg.F (7 deg.C). Maintain containers used in storage in a clean condition, free of foreign

materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.6 JOB CONDITIONS

- A. The building must be completely enclosed and dried-in. Perform moisture test on masonry walls prior to application of paint. Moisture levels must meet manufacturers requirements.
- B. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 deg.F (10 deg.C) and 90 deg.F (32 deg.C).
- C. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 deg.F (7 deg.C) and 95 deg.F (35 deg.C).
- D. Do not apply paint in snow, rain, fog, or mist, when relative humidity exceeds 85 percent, at temperatures less than 5 deg.F (3 deg.C) above the dew point, or to damp or wet surfaces.
 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

PART 2 – PRODUCTS

NOTE: SEE PAINT SCHEDULES AT THE END OF THIS SECTION.

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following, or approved substitute:
 1. PPG Porter Paints (Porter)
 2. Glidden Professional (Glidden)
 3. The Sherwin-Williams Company (S-W).

2.2 MASONRY BLOCK FILLER

- A. High-Performance Epoxy Block Filler: Heavy-duty epoxy block fillers used for filling open textured interior and exterior concrete masonry block before application of top coats:
 1. Porter: 95-217 PPG Cementitious Waterproofing Block Filler

2.3 PRIMERS:

- A. Exterior Primer : Exterior acrylic wood primer used for priming wood or gypsum board under a flat acrylic emulsion finish:
 1. Porter: PPG 6-609 Speedhide Exterior Acrylic Wood Primer.
 2. Glidden: 6001 HYDROSEALER Primer Sealer

3. S-W: B42W41 A-100 Exterior Latex Primer.
- B. 100% Acrylic Interior Primer: 100% Acrylic primer-sealer for interior gypsum drywall:
1. Porter: PPG 17-951 Seal Grip Acrylic Primer Finish.
 2. Glidden: 1010 High-Hide Interior Primer Sealer.
 3. S-W: Prep-Rite Classic Primer B-28.
- C. Synthetic, Rust-Inhibiting Primer: Quick-drying, rust-inhibiting primer for priming interior and exterior ferrous metal surfaces:
1. Porter: PPG 6-208 Speedhide Rust Inhibitive Metal Primer.
 2. Glidden: 4160 Devguard Multi Purpose Primer
 3. S-W: Kem Kromik Metal Primer B50N2/B50W1.
- D. Galvanized Metal Primer: Primer used to prime interior and exterior zinc-coated (galvanized) metal surfaces:
1. Porter: PPG 90-712 Pitt Tech DTM Acrylic Metal Primer.
 2. Glidden: 4020PF Devflex DTM Primer Finish.
 3. S-W: Galvite B50W3.
- E. Epoxy Metal Primer: Primer used to prime ferrous metal handrails:
1. Porter: PPG 95-245 Pitt Guard DTR Rapid Coat Epoxy Mastic Primer.
 2. Glidden: PPG 95-245 Pitt Guard DTR Rapid Coat Epoxy Mastic Primer.
 3. S-W: Equal Product.

2.4 EXTERIOR FINISH PAINT MATERIAL

- A. Exterior Flat Acrylic Emulsion: Quick-drying, flat, acrylic paint for use on the exterior over concrete, stucco, masonry (including masonry block), and primed gypsum board:
1. Porter: PPG 6-610XI Speedhide Exterior Acrylic Flat.
 2. Glidden: 2200 Ultra Hide 150 Exterior Acrylic Flat
 3. S-W: A-100 Acrylic Latex Flat Exterior Finish A-6 Series.
- B. Exterior Semi-Gloss Acrylic Emulsion: Semi Gloss Acrylic paint for use over prime-coated ferrous or galvanized metal:
1. Porter: PPG 6-900XI Speedhide Acrylic Semi Gloss Exterior Paint.
 2. Glidden: 2416 Ultra Hide 150 Exterior Acrylic SemiGloss
 3. S-W: A-100 Exterior Acrylic Gloss A8W16.
- C. Gloss Urethane Enamel: Urethane finish for ferrous metal handrails:
1. Porter: PPG 95-812 Pitthane Ultra Gloss Urethane Enamel.
 2. Glidden: PPG 95-812 Pitthane Ultra Gloss Urethane Enamel.
 3. S-W: Equal Product.

2.5 INTERIOR FINISH PAINT MATERIAL

- A. Latex-Based Interior Flat Paint: Ready-mixed, latex-based paint for use as a flat finish over concrete and masonry surfaces, including filled concrete masonry block, mineral-fiber-reinforced cement panels, and

plaster and over prime-coated gypsum drywall, ferrous metal, and zinc-coated (galvanized) metal surfaces:

1. Porter: PPG 6-70 Speedhide Latex Flat Wall Paint
2. Glidden: 1210 Ultra Hide Latex Flat Wall Paint
3. S-W: Pro-mar 200 Latex Flat Wall Paint B30W201.

B. Latex-Based Interior Semi-Gloss Paint: Ready-mixed, latex-based paint for use as a finish over prime-coated gypsum drywall, concrete block, ferrous metal, and zinc-coated (galvanized) metal surfaces.

1. Porter: PPG 6-500 Speedhide Interior Semi-Gloss Latex.
2. Glidden: 1416 Ultra Hide Latex Semi Gloss Enamel.
3. S-W: Pro-mar 200 Latex Semi-Gloss Enamel B31W201.

C. Water Borne Polyamide Epoxy: Paint system for use over concrete masonry block, with manufacturer's recommended primer:

1. Porter: 98-1 Aquapon WB Gloss Polyamide Epoxy.
2. Glidden: 98-1 Aquapon WB Gloss Polyamide Epoxy.
3. S-W: B73W00111 – Waterbased Tile-Clad Epoxy.

D. Alkyd Gloss Enamel for use over a primer and undercoat on interior plaster surfaces, wood, and hardboard and ferrous and zinc-coated metal surfaces:

1. Porter: PPG 7-282 Industrial Oil Base Gloss Enamel.
2. Glidden: 4308 Devguard Alkyd Gloss Enamel.
3. S-W: Industrial Enamel B-54 Series.

2.6 MISCELLANEOUS WOOD FINISHING MATERIALS

A. Satin Polyurethane: Clear polyurethane with satin finish for use over wood surfaces.

1. Porter: 43886 Olympic Satin Polyurethane Varnish.
2. Glidden: 1902 Woodpride Satin Polyurethane Varnish.
3. S-W: Wood Classics Satin Polyurethane A67F1.

B. Gloss Polyurethane: Clear Gloss Polyurethane thinned per manufacturer's recommendations as a sealer under satin finish coat.

1. Porter: 43884 Olympic Gloss Polyurethane Varnish. (Thin 10% as a sealer)
2. Glidden: 1908 Woodpride Gloss Polyurethane Varnish. (Thin per mfg. recommendations)
3. S-W: Wood Classics Gloss Polyurethane A67V1. (Thin per mfg. recommendations)

C. Oil-Type Interior Wood Stain: Slow-penetrating oil-type wood stain for general use on interior wood surfaces under varnishes or wax finishes:

1. Porter: 41570 Olympic Fast Dry Wood Stain.
2. Glidden: 1700 Woodpride Oil Stain.
3. S-W: Oil Stain A-48 Series.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint. Do not begin paint application until unsatisfactory conditions have been corrected.
 - 1. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

3.2 PREPARATION

- A. General Procedures: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items if necessary for complete painting of the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.
 - 1. Clean surfaces before applying paint or surface treatments. Remove oil and grease prior to cleaning. Schedule cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- B. Surface Preparation: Clean and prepare surfaces to be painted in accordance with the manufacturer's instructions for each particular substrate condition and as specified.
 - 1. Provide barrier coats over incompatible primers or remove and reprime. Notify Architect in writing of problems anticipated with using the specified finish-coat material with substrates primed by others.
- C. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation. All block surfaces shall be patched, cleaned, touched up prior to application of Blockfill.
 - 1. Use abrasive blast-cleaning methods if recommended by the paint manufacturer.
 - 2. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
- D. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - 1. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer before application of primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- E. Ferrous Metals: Clean nongalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council.
 - 1. Apply alkyd metal primer over bare and shop primed metal. Prepare the surface to be painted according to manufacturers recommendation.
- F. Galvanized Surfaces: Clean galvanized surfaces with non-petroleum-based solvents so that the surface is free

of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

- G. Materials Preparation: Carefully mix and prepare paint materials in accordance with manufacturers directions.
1. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.
 2. Stir materials before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
 3. Use only thinners approved by the paint manufacturer, and only within recommended limits.

3.3 APPLICATION

- A. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
- B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
1. Paint colors, surface treatments, and finishes are indicated in "schedules".
 2. Provide finish coats that are compatible with primers used.
 3. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.
 4. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convactor covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.
 6. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.
 7. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.
 8. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 9. Finish exterior doors on tops, bottoms, and side edges same as exterior faces.
 10. Sand lightly between each succeeding enamel or varnish coat.
 11. Omit primer on metal surfaces that have been shop-primed and touch up painted.

- C. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
 - 1. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
- D. Minimum Coating Thickness: Apply materials at not less than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire system as recommended by the manufacturer.
- E. Mechanical and Electrical Work: Painting mechanical and electrical work is limited to those items exposed in mechanical equipment rooms and in occupied spaces.
- F. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with all pores completely filled.
- G. Prime Coats: Before application of finish coats, apply a prime coat of material as recommended by the manufacturer to material that is required to be painted or finished and has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to assure a finish coat with no burn through or other defects due to insufficient sealing.
- H. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- I. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

3.4 CLEANING

- A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
- B. Upon completion of painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping, using care not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

- A. Protect work of other trades, whether to be painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
- B. Provide "wet paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.
 - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINT SCHEDULE

- A. General: Provide the following paint systems for the various substrates indicated.
 - 1. Gypsum Board:
 - a. Water Borne Polyamide Epoxy

- .1 Primer: High Performance Latex Block Filler
 - .2 First Coat: Water Borne Polyamide Epoxy
 - .3 Second Coat: Water Borne Polyamide Epoxy.
2. Ferrous Metal:
- a. Exterior Semi Gloss Acrylic Finish: 2 finish coats over primer.
 - .1 Primer: Synthetic Rust-Inhibiting Primer.
 - .2 First Coat: Exterior SemiGloss Acrylic Emulsion.
 - .3 Second Coat: Exterior SemiGloss Acrylic Emulsion.
3. Zinc-Coated Metal:
- a. Exterior Semi Gloss Acrylic Finish: 2 finish coats over primer.
 - .1 Primer: Galvanized Metal Primer.
 - .2 First Coat: Exterior SemiGloss Acrylic Emulsion.
 - .3 Second Coat: Exterior SemiGloss Acrylic Emulsion.
4. Ferrous Metal (Handrails only):
- a. Exterior Gloss Urathane Finish: 2 finish coats over primer.
 - .1 Primer: Epoxy Metal Primer.
 - .2 First Coat: Exterior Gloss Urethane Enamel.
 - .3 Second Coat: Exterior Gloss Urethane Enamel.

3.7 INTERIOR PAINT SCHEDULE

A. General: Provide the following paint systems for the various substrates, as indicated.

1. Concrete Masonry Units:
- a. Water Borne Polyamide Epoxy
 - .1 Primer: High-Performance Epoxy Block Filler
 - .2 Primer: High-Performance Epoxy Block Filler
 - .3 First Coat: Water Borne Polyamide Epoxy
 - .4 Second Coat: Water Borne Polyamide Epoxy
2. Gypsum Drywall Systems:
- a. Latex-Based Interior Semi-Gloss Paint 2 finish coats over primer, at exposed gypsum drywall.
 - .1 Primer: 100% Acrylic Interior Primer.
 - .2 First Coat: Latex-Based Interior Semi-Gloss Paint.
 - .3 Second Coat: Latex-Based Interior Semi-Gloss Paint.
 - b. Primer Finish: Primer, at concealed gypsum drywall.
 - .1 Primer: 100% Acrylic Interior Primer.

3. Ferrous Metal:
 - a. Semi-Gloss Finish: 2 finish coats over primer.
 - .1 Primer: Synthetic Rust-Inhibiting Primer.
 - .2 First Coat: Alkyd Gloss Enamel.
 - .3 Second Coat: Alkyd Gloss Enamel.

4. Zinc-Coated Metal:
 - a. Semi-Gloss Finish: 2 finish coats over primer.
 - .1 Primer: Galvanized Metal Primer.
 - .2 First Coat: Latex-Based Interior Semi-Gloss Paint.
 - .3 Second Coat: Latex-Based Interior Semi-Gloss Paint.

5. Stained Woodwork:
 - a. Stained-Satin Finish: 2 finish coats over stain.
 - .1 Stain Coat: Oil-Type Interior Wood Stain.
 - .2 First Coat: Gloss Polyurethane (Thin per manufacturer recommendation).
 - .3 Second Coat: Satin Polyurethane.

END OF SECTION 09900

SECTION 10520 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Portable fire extinguishers.
 - 2. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.
 - 3. Fire-protection accessories.
- B. Related Sections include the following:
 - 1. Division 9 Section "Painting" for field-painting fire-protection cabinets.
 - 2. Division 10 Section "Signs" for directional signage to out-of-sight fire extinguishers and cabinets.
 - 3. Division 11 Section "Food Service Equipment" for fire extinguishing systems provided as part of exhaust hoods.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.
 - 1. Fire Extinguishers: Include rating and classification.
 - 2. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire extinguishers and cabinets through one source from a single manufacturer.
- B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."
- C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide extinguishers listed and labeled by FM.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Portable Fire Extinguishers:
 - a. Amerex Corporation.
 - b. Ansul Incorporated.
 - c. Badger; Div. of Figgie Fire Protection Systems.
 - d. Buckeye Fire Equipment Company.
 - e. Fire-End & Croker Corporation.
 - f. J.L. Industries, Inc.
 - g. Kidde: Walter Kidde, The Fire Extinguisher Co.
 - h. Larsen's Manufacturing Company.
 - i. Moon/American, Inc.
 - j. Pem All; Div. of Pem Systems, Inc.
 - k. Potter-Roemer; Div. of Smith Industries, Inc.
 - l. Pyro-Chem; Tyco Safety Products

2.2 PORTABLE FIRE EXTINGUISHERS

- A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.
- B. Multipurpose Dry-Chemical Type: UL-rated 4-A:60-B:C, 10-lb (4.5-kg) nominal capacity, in enameled-steel container.

2.3 FIRE-PROTECTION CABINETS

- A. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated, sized to fit specified extinguisher. Weld joints and grind smooth. Miter and weld perimeter door frames.
1. Cabinet Metal: Enameled-steel sheet.
- B. Cabinet Type: Suitable for the following:
1. Fire extinguisher.
- C. Cabinet Mounting: Suitable for the following mounting conditions:
1. Semirecessed: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated.
- D. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.
1. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - b. Rolled-Edge Trim: 4-inch (102-mm) backbend depth.
- E. Cabinet Trim Material: Manufacturer's standard, as follows:
1. Same metal and finish as door.

- F. Door Material: Manufacturer's standard, as follows:
 - 1. Aluminum sheet.
- G. Door Glazing: Manufacturer's standard, as follows:
 - 1. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, as follows:
 - a. Class 1 (clear), 1/8" Thickness.
- H. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

2.4 ACCESSORIES

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish.
 - 1. Provide brackets for extinguishers located in cabinets.

2.5 COLORS AND TEXTURES

- A. Colors and Textures: As selected by Architect from manufacturer's full range for these characteristics.

2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for hose valves, hose racks, and cabinets to verify actual locations of piping connections before cabinet installation.

- B. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets are to be installed.
- C. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged units.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing fire-protection specialties.
- B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction. Mount cabinet so that top of extinguisher shall be no greater than 60" A.F.F.
 - 1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.

3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust cabinet doors that do not swing or operate freely.
- B. Refinish or replace cabinets and doors damaged during installation.
- C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 10520

SECTION 12304 - GENERAL CASEWORK

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Applicable provisions of General Conditions, Special Conditions and General Requirements shall apply to this section as if repeated in full herein. Reference other Sections and Divisions for work in connection with this section.

1.2 INTENT

- A. It is the purpose of this specification to establish requirements for casework to provide the purchaser with a durable and functional installation.
- B. As the Casework has been designed to meet the functional requirements of each area, it is the desire of the purchaser that door and drawer arrangements, design of casework layouts and work surface materials must not be changed.
- C. Construction methods, joinery, materials, and material thickness shall be strictly adhered to in order to provide the owner with a final installation capable of performing as those specified. Bids proposing to supply casework not meeting these requirements will be rejected.

1.3 WORK INCLUDED

- A. Furnish, deliver, and install to owner's and architect's satisfaction, all prefabricated plastic laminate casework as shown on drawings, schedules and equipment lists.
- B. Furnish and install all fillers, scribes, finished ends, finished backs, work surfaces, backsplashes, and cutouts required to provide a complete and finished project. Plastic laminate work surfaces shall include backer sheet.
- C. Provide sinks and fittings, electrical outlets and fixtures when specifically stated as being part of this contract.
- D. Provide locks where shown on casework drawings or described in equipment lists.

1.4 WORK IN OTHER SECTIONS

- A. All sinks and fittings, couplings and connectors, piping, traps, supplies, shutoffs, and special plumbing fixtures to meet all applicable codes; all electrical fixtures and devices, conduit, wiring and connectors; and all fans, blowers, motors, ductwork, and metal grilles not specified as part of casework contract.
- B. Installation, connection, and testing of all sinks, fittings, electrical fixtures; providing all rough-ins: mechanical piping; electrical runs; and connections required for a complete project.
- C. Blocking, framing, and reinforcement in walls, ceilings, and floors for anchoring of cabinets and trim.
- D. General millwork and running wood trim items.
- E. Vinyl base molding.

1.5 MANUFACTURERS:

- A. General Casework: Products and catalog numbers are from Stevens CaseMaster Series catalog and are used as basis for identification, configuration, size, and quality.
- B. The casework shall conform to configuration, arrangement, design, material quality, joinery, panel thickness, and surfacing of that specified and shown on drawings. The following manufacturers are approved provided product is bid per specifications:
 - 1. Advanced Cabinet Systems (ACS)
 - 2. Stevens CaseMaster Series
 - 2. Habersham

1.6 SUBMITTALS

- A. Shop drawings shall be submitted for approval within thirty (30) days after formal notification of award of contract. Drawings shall consist of floor plans indicating arrangement and relation to adjacent work and equipment, and complete elevations of casework. Centerline of service requirements shall be noted for use by other trades. A schedule of all sinks, fittings, and accessories that are part of this contract shall be provided.
- B. Color samples shall be submitted for selection and coordination at time of contract award. Samples of actual material and color shall be available as required.
- C. Additional catalog cuts, details and samples as requested by architect for evaluation and coordination.

1.7 PRODUCT DELIVERY AND STORAGE

- A. Protect cabinet and countertops during transit, delivery, storage and handling to prevent damage, soiling and deterioration.
- B. Store cabinets and countertops at project site installation and storage areas with similar ambient conditions as final installation. Storage areas must be kept dry, heated with low relative humidity and away from construction work such as painting, wet work, grinding and similar operations.

1.8 WARRANTY

- A. Casework manufacturer shall warrant for a period of three (3) years, the product manufactured by it to be free from defects in material and workmanship when properly installed under normal use.
- B. Accessory equipment (sinks, fittings, etc.), if required, shall be warranted by appropriate manufacturer's guarantee.

PART 2 PRODUCTS

2.1 CORE MATERIAL

- A. Cabinet components having particle board core material shall be of a minimum 45 lb. density, M-2 industrial grade. The particleboard used shall have been tested under ANSI A208.1 1993 standards and / or ASTM D 1037-91A.
- B. Medium density fiberboard (MDF) shall be used in high stress areas as drawer members and shall be minimum 48 lb. density MD-21 grade and tested under ANSI A208.2 1994 Standards

- C. Industrial hardboard shall be pre-finished 1/4" thickness composed of wood fibers, phenolic resin binders and moisture inhibitors that meet or exceed the hardboard product standard ANSI/AHA A135.4 1988.

2.2 SURFACE MATERIAL

- A. Exposed exteriors shall be:
High pressure decorative plastic laminate thermoset to core using catalyzed PVA glue with a minimum average pressure of 90 PSI and average 180 degree F. temperature. High pressure decorative plastic laminate shall meet NEMALD 3-1995, VGS.028 specification standards.
- B. Exposed doors and drawer fronts shall be:
High pressure decorative plastic laminate thermoset to core using catalyzed PVA glue with a minimum average pressure of 90 PSI and average 180 degree F. temperature. High pressure decorative plastic laminate shall meet NEMALD 3-1995, VGS.028 specification standards.
- C. Exposed interiors shall be:
Permanently thermofused melamine laminate, fused to core using a minimum average pressure of 320 PSI and average 320 degree F. temperature. Thermofused melamine laminate shall meet ALA 1996 specification standards, as tested against the high pressure laminate NEMA LD 3-1995, VGS.028 specification standards. (Warranted for life against declamations.)
- D. Semi-exposed and concealed surfaces shall be permanently thermofused melamine laminate or high pressure decorative plastic laminate cabinet liner, 0.020" thickness for balanced construction. Thermofused melamine laminate shall meet the ALA 1996 specifications standards, as tested against the high pressure laminate NEMA LD 3-1995, VGS.028 specification standards.

2.3 EDGINGS

- A. Exposed exterior cabinet front edges shall be banded with a contrasting or matching rigid PVC extrusion, 0.020" in thickness, resistant to chip, crack and high impact. Edging shall have a satin finish with a UV cured top coat for additional durability. The 0.020" thick edging shall be applied with waterproof hot melt adhesive.
- B. Door and drawer front edges shall be:
Banded with a contrasting or matching rigid PVC extrusion, 3mm (1/8") thickness, resistant to chip, crack, and high impact. Edging shall have a satin finish with UV cured top coat for additional durability. The 3mm thick edging shall be applied with waterproof hot melt adhesive, and shaped to provide radiused edges and radiused corners.
- C. Adjustable shelves shall be banded with PVC extrusion, resistant to chip, crack, and high impact. Edging shall have a satin finish with a UV cured top coat for additional durability. Edging shall be applied with waterproof hot melt adhesive. 0.020" thick PVC edging shall be applied to front edge of adjustable shelf.
- D. All other interior components, including drawers, shall be banded with a PVC extrusion, 0.020" in thickness, resistant to chip, crack, and high impact. Edging shall have a satin finish with a UV cured top coat for additional durability. Edging to be machine applied with waterproof hot melt adhesive.

2.4 COLOR SELECTIONS

- A. Exposed cabinet exteriors shall be chosen from:
Wilsonart, (Design Group One), Formica, or Pionite color groups in high pressure decorative plastic laminate.

- B. Exposed doors and drawer fronts shall be chosen from:
Wilsonart, Formica, or Pionite color groups in high pressure decorative plastic laminate.
- C. Semi-exposed surfaces, including drawer box components, shall be finished in either pearl or grey as selected from casework manufacturer's standard interior color selections.
- D. Exposed interior components, including both faces of shelves and interior face of backs to be pearl or grey.
- E. Door and drawer front edges shall be chosen from one of twenty-two (22) trim group colors in 3mm thick PVC in contrasting or matching colors as depicted in manufacturer's color guide.
- F. Exposed front edge of cabinet, including exposed interior edges, shall be selected from one of seventy (70) trim group colors in 0.020" thick PVC in contrasting or matching colors as depicted in manufacturer's color guide, or commercial match to selected exposed exterior color based on availability.
- G. Semi-exposed edges of cabinet components including drawers, shall be either pearl or grey in 0.020" thick PVC.
- H. Five knuckle hinges shall be available with black, pearl or chrome epoxy finish.
- I. Pulls shall be available in chrome, brass, bent wire and injection molded pulls in either bent wire or contour design, to be available in twenty (20) colors as selected from manufacturer's color selector.
- J. Casework of substitute brands with lesser amounts or more restrictive selection requirements will not be considered equal and shall be rejected.
- K. Finishes to be laminate manufacture's matte, suede, or equivalent finish as approved by architect. Samples will be reviewed by architect for color, texture, and pattern only.

2.5 HARDWARE

- A. Hinges shall be:
Heavy duty five knuckle style, with interlaying leaves capable of 270 degree swing. Hinge shall be constructed of 0.090" minimum thickness steel with black, pearl or chrome epoxy finish, hospital tipped with non-removable pin. Doors less than 48" in height shall have two (2) hinges per door. Doors exceeding 48" in height shall have three (3) hinges per door.
- B. Door catches shall be a heavy-duty spring loaded, large diameter (17.5mm - 11/16") roller type catch mounted at bottom edge. All doors over 48" in height shall be provided with roller catch at both top and bottom of door.
- C. Catch strike plate shall be injection molded ABS, with an integrally molded engagement ridge. Strike plate shall also provide a wide face bumper insuring a positive door stop.
- D. Pulls shall be impact resistant injection molded nylon bent wire, 4" length available per color selection in article 2.04.I.
- E. Drawer and slide out shelves shall be suspended with bottom mount, side and bottom attached nylon roller epoxy coated steel slides to ensure quiet, smooth operation. Lateral stability is achieved thru a special formed captive profile. Slides shall have 100 lb. load rating, with both in and out drawer stop, 3" self close feature and a side adjustment cam allowing 3mm side to side alignment.
- F. Drawers specifically noted for full extension file use shall be suspended with bottom mount, side and bottom attached nylon roller epoxy coated steel slides to ensure quiet, smooth operation. Lateral

stability is achieved thru a special formed captive profile. Slides shall have 150 lb. load rating, with both in and out drawer stop, and 3" self close feature. File drawer shall include extruded top mounted molded side rails to accept standard hanging file folders.

- G. Knee-space, pencil drawers, and keyboard trays, shall be designed to permit under counter or support frame mounting, with 100 lb. nylon roller epoxy coated steel slides.
- H. Hanger rods shall be heavy chrome plated tubing. Rod shall be securely affixed to cabinet shelves.
- I. Tote trays shall be of high impact polystyrene with smooth edges. Each tray to include an identification card holder and shall be suspended from rails securely attached to cabinet verticals.
- J. Shelf support clips for 1" thick adjustable shelves shall be injection molded clear polycarbonate. Support clips shall incorporate integral molded lock tabs to retain shelf from tipping or inadvertently being lifted out. Support clip shall have 5mm dia. double pin engagement into precision bored hole pattern in cabinet vertical members. Clips shall have a molded ridge which provide pressure against edge of shelving to maintain positive pin engagement. Clip shall be designed in such a manner to provide means for permanent retention to shelf. Static test load must exceed 200 lb. per clip.
- K. Dividers that are 1/4" thick shall be fully adjustable and retained with injection molded clear polycarbonate clip.
- L. Locks shall be cylinder type, diecast, with five (5) disc tumbler mechanism. Each lock shall be provided with milled brass key. Master keying shall be available. Cabinets with multiple locks installed shall be keyed alike by room, with each cabinet keyed different unless otherwise specified. Locks shall be Remov-A-Core to give flexibility for different pass key options. Locks shall be provided where indicated on equipment drawings as an option or as part of standard catalog cabinet description.
- M. Sliding door track shall be double channel rigid PVC extrusion at both top and bottom of doors. Track shall be available in pearl, black or grey colors.
- N. Teacher wardrobe mirrors shall be 7/32" (6mm) thick polished plate mirror.

2.6 COMPONENTS

- A. Base, Wall and Tall cabinet ends shall be 3/4" thick particle board, laminated for balanced construction, surfaced as described in article 2.02.A and edged as described in article 2.03.A.
- B. Base and Tall cabinet tops and bottoms shall be 3/4" thick particle board, laminated for balanced construction, surfaced as described in article 2.02.C, and edged as described in article 2.03.A.
- C. Wall cabinet top and bottom shall be 1" thick particle board, laminated for balanced construction, surfaced as described in article 2.02.C, and edged as described in article 2.03.A.
- D. Vertical cabinet members shall be 3/4" thick particle board, laminated for balanced construction, surfaced as described in article 2.02.C, and edged as described in article 2.03.D.
- E. Cabinet backs shall be 3/4" thick pre-finished industrial hardboard.
- F. Frame rails shall be 3/4" thick x 3 3/4" wide particle board, laminated for balanced construction, surfaced, as described in article 2.02.C, and edged as described in article 2.03.A.
- G. Sub base shall consist of:

Two (2) toe kick support rails shall be 3/4" thick x 3 3/4" high particle board and be inset from cabinet front and back edge, to give additional load support.

- H. Mounting rails shall be 3/4" thick x 3 3/4" wide particle board. Wall cabinets shall have rails positioned at the top and bottom. Tall cabinets shall have rails positioned at the top and intermediate location. Base cabinet shall have rails positioned at the top of unit.
- I. Drawers shall be full box design with a separate front. Drawer sides and ends shall be constructed of 5/8" medium density fiberboard with pearl or grey color thermofused melamine laminate and matching PVC top edges. Bottoms shall be 1/4" thick medium density fiberboard, pearl or grey color thermofused melamine laminate.
- J. Adjustable shelves shall be 1" thick. Edges of shelf shall be banded as described in article 2.03.C with a high impact, rigid PVC extrusion, pearl or grey in color.
- K. Sliding display doors shall be constructed of 1/4" thick distortion free glazing sheet. Center edge shall be capped with full length aluminum channel. Aluminum channel shall be custom extruded, clear etched and anodized. Full length extruded aluminum channel shall be used on outer edges.
- L. Solid hinged doors, sliding doors and drawer fronts shall be 3/4" thick material of balanced construction, surfaced as described in section 2.02.B, edged as described in article 2.03.B

2.7 CONSTRUCTION

- A. Cabinet parts shall be accurately machined and precision bored for premium grade quality joinery construction, utilizing automatic machinery to ensure consistent sizing on modular cabinets. Cabinets shall be assembled under controlled case clamp conditions, assuring final cabinet squareness and proper joint compressions.
- B. Cabinet ends shall be bored to receive 8mm, industrial grade hardwood laterally fluted dowels with chamfered ends. Cabinet ends shall be prepared to receive adjustable shelf hardware at 32mm (approximately 1 1/4") centers. Door hinges and drawer slides shall be machined drilled to maintain vertical and horizontal alignment of components. Inset grooving with chamfer shall be machined 3/4" from rear edge to accept the 1/4" back. Base and Tall units shall have one piece end panels continuous to floor for added load capabilities.
- C. Tops and bottoms shall be joined to cabinet ends using a minimum of six (6) dowels at each joint for twenty-four (24) inch deep cabinets and a minimum of four (4) dowels at each joint, for twelve (12) inch deep cabinets. All dowels to be industrial grade hardwood, laterally fluted, with chamfered ends and 8mm in diameter. Top of base cabinet will be full depth. Inset grooving with chamfer shall be machined 3/4" from rear edge to accept the 1/4" back.
- D. Vertical dividers shall be bored to receive adjustable shelf hardware at 32mm (approximately 1 1/4") centers. Dividers shall be joined to tops and bottoms with 8mm diameter hardwood dowels.
- E. Frame rails shall be joined to ends with 8mm diameter hardwood dowels.
- F. Two (2) toe kick supports shall be inset from cabinet front and back edges, and doweled into cabinet ends with 8mm hardwood dowels.
- G. Mounting rails shall be fully concealed behind backs. Rails shall be 3/4" thick and fastened to cabinet ends with 8mm hardwood dowels. Wall and tall cabinet shall incorporate two mounting rails. Wall cabinets shall have rails positioned at top and bottom. Tall cabinets shall have rails positioned at top and intermediate location. Base units shall have rail positioned in the upper back area.
- H. Back panels shall be 3/4" thick and inset 3/4" from rear edge of cabinet. Back shall be glued and continuously trapped in top, bottom, and ends of cabinets.

- I. Drawer corner joints shall be interlocking dowel pin design. Hardwood dowel pins, 8mm diameter shall be inserted into drawer fronts and backs to fit into machined hole patterns in drawer sides. Bottoms shall be trapped into grooves on all four sides glued and mechanical fastened. Drawers shall be suspended on slides as described in article 2.05.E.

2.8 WORK SURFACES

- A. Core material having particle board shall be of a minimum 45 lb. density, M-2 industrial grade. The particleboard used shall have been tested under ANSI A208.1 1993 standards and / or ASTM D 1037-91A.
- B. Surface material shall be:
High pressure decorative plastic laminate thermoset to core using catalyzed PVA glue with a minimum average pressure of 90 PSI and average 180 degree F. temperature. High pressure decorative plastic laminate shall meet NEMALD 3-1995, HGS.048 specification standards.
- C. Color selection shall be:
Wilsonart, Formica, or Pionite color groups in high pressure decorative plastic laminate.
- D. Exposed edges shall be banded with same laminate as work surfaces. The edging shall be applied with waterproof hot melt adhesive.
- E. Underside of all work surfaces to have BK-20 backer or approved equivalent. This balance sheet shall be thermoset to core using catalyzed PVA glue with a minimum average pressure of 90 PSI and average 180 degree F. temperature.
- F. Design and construction of work surfaces shall be...
30mm (1-3/16") thick with 90 degree (90 degree roll-edge standard) postformed radius HGP.039 laminate at front edge. Laminate countertops shall have wafers for alignment and tight-joint fasteners at all joints. Top edge of separate backsplashes to have 90 degree radius profile on upper edge. Where countertops abut wall, separate end splashes are to be provided.
- G. All outside corners to have 1" radius on all countertops.
- H. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

Corian
LG Chemical, Ltd.
Wilsonart International; Div. of Premark International, Inc.

Type:

Colors and Patterns: As selected by Architect from manufacturer's full range

PART 3 EXECUTION

3.1 INSTALLATION

- A. The installer must examine the job site and the conditions under which the work in this section is to be performed, and notify the contractor in writing of any unsatisfactory conditions. Do not proceed with

work under this section until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

- B. Casework, countertops, and related materials to be conditioned to average prevailing humidity condition in installation areas prior to start of work.
- C. Install casework and countertops with factory-trained supervision authorized by manufacturer. Casework shall be installed plumb, level, true and straight with no distortions. (Shim as required.) Securely attached to building structure with anchorage devices of appropriate type, size and quantity to meet applicable codes, specifications and safety conditions. Where laminate clad casework and countertops abuts other finished work, scribe and trim to accurate fit.
- D. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by the manufacturer.
- E. Repair, or remove and replace, defective work as directed upon completion of installation.
- F. Clean plastic surfaces, repair minor damage per plastic laminate manufacturer's recommendations. Replace other damaged parts of units.
- G. Advise contractor of procedures and precautions for protection of casework and countertops from damage by other trades until acceptance of work by owner.
- H. Cover casework with 4-mil polyethylene film for protection against soiling and deterioration during remainder of construction period.

END OF SECTION - 12304

SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Electrical equipment coordination and installation.
 - 2. Sleeves for raceways and cables.
 - 3. Sleeve seals.
 - 4. Common electrical installation requirements.

1.3 DEFINITIONS

- A. ATS: Acceptance Testing Specifications.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

- A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

1.6 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."
- D. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.138-inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

2.3 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM, NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 3. Pressure Plates: Carbon steel Include two for each sealing element.

4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.4 MOUNTING HEIGHTS

1. Unless otherwise noted on the drawings or required by the architect, the following mounting heights shall apply:

Toggle switches	4'0"
Receptacles	1'6"
Panelboards	6'6" to top

2. Fire alarm visual, audio and audio/visual devices - per ADA requirements (80" above highest floor level within space or 6" below ceiling, whichever is lower)
3. System clocks shall be mounted at 8'6" above the finished floor. Coordinate the exact location and mounting height of all systems clocks with the engineer/architect prior to rough-in.

Upon approval of architect, mounting heights may be adjusted to simplify cutting of blocks, masonry or bricks.

2.5 SHOP DRAWING SUBMITTAL

1. As soon as practical after the contract is let submit (shop drawings) to the Architect of complete descriptive and dimensional data on:

lighting fixtures
panelboards
2. Shop drawings shall be bound in a three ring binder and shall include index page with each item listed. **All shop drawings shall be prepared and submitted as a single package.**
3. The contractor shall review the information prepared by his suppliers and note any changes required prior to submitting the information to the engineer and shall include the form, Exhibit 2, entitled "Certification of Compliance - Shop Drawings" with each submittal. Failure to complete and execute this form will result in rejection of the submittal without review.
4. The contractor shall prepare dimensioned rough-in drawings (1/2"=1'0" scale) for each equipment room. These drawings shall show all equipment to scale (based on actual equipment purchased) and shall be fully dimensioned.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."
- C. Concrete Slabs and Walls: Install sleeves for penetrations. Install sleeves during erection of slabs and walls.
- D. Rectangular Sleeve Minimum Metal Thickness:
 - 1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches , thickness shall be 0.052 inch .
 - 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches , thickness shall be 0.138 inch .
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with Division 7 Section "Through-Penetration Firestop Systems."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Through-Penetration Firestop Systems."

3.5 ELECTRICAL WORK CLOSEOUT

1. During electrical closeout phase, meet with owner's operating representative frequently and agree upon status of operational responsibility for electrical systems, including security provisions to prevent unauthorized operation, including protective measures to ensure that systems are not neglected or misused.
2. Except where otherwise indicated, electrical contract drawings are diagrammatic in nature and may not show locations accurately for various components of electrical systems. Shop drawings prepared by the contractor show certain portions more accurately to scale and location, and in greater detail. It is recognized that actual layout of installed work may vary substantially from both contract drawings and shop drawings.
3. In addition to the requirement of the Division 1 specifications, the contractor shall furnish the following electrical closeout documents:
4. Maintain blue-line or black-line set of electrical drawings and shop drawings in clean undamaged condition, for mark-up of actual installations which vary substantially from work as shown. Select and mark-up drawings which are most capable of showing installed conditions accurately. Mark with erasable pencil, and use multiple colors to aid in distinguishing between systems. In general, record every substantive installation of electrical work which is not shown or has been shown inaccurate, but in any case record the following:

underground conduits both interior and exterior, drawn to scale and fully dimensioned.

Work concealed behind or within other work, in a non-accessible arrangement.

Mains and branches of wiring systems, with switchboards, panelboards and control equipment and devices located and numbered.

Scope of each change order, denoting change order number.

Grounding system

sensor and signal locations of alarms and control systems.

The engineer will furnish the contractor through the Architect electronic files in AutoCAD format of the Contract Electrical Drawings for the Contractor use in preparing final electronic As-Built drawings. The contractor shall update these drawings indicating all project addenda, change order and As-Built conditions as listed above. Submittal of the Electronic Drawings shall be made on compact disk in AutoCAD format and accompany one full size set of bond plots to the Engineer in color on white background. Plots shall be generated from the CD As-Built Electronic files. Electronic file names and plot sheet numbering shall match the Contract Document format.

5. Work shall be recorded when performed. Failure to record work in a timely manner shall be considered sufficient reason to reject such work. At each site visit of Architect/Engineer, have the "in-progress" record drawings available to the engineer for his review.
6. Prior to transmittal of record drawings; obtain a set of prints for each contract drawing that has been used to record installed conditions. Erase incorrect information and transfer correct information onto the prints. Transmit corrected drawings to the architect for the owners' use.

SECTION 16000 - Exhibit No. 2

CERTIFICATION OF COMPLIANCE - SHOP DRAWINGS

To:
Project:

I have reviewed the contract documents, including but not limited to specifications, drawings, addenda, and change orders. To the best of my knowledge the materials described by the enclosed shop drawings are consistent with and meet the requirements of the aforementioned documents. I further recognize that; 1) the engineers review is to assist me in complying with the documents by checking for errors in my interpretation of the requirements set forth in the contract documents, 2) review of shop drawings, by the engineer, shall not relieve me of my responsibility for confirming and correlating all quantities, dimensions and work with that of other trades, and for performing the work in a safe and satisfactory manner, and 3) review of shop drawings, by the engineer, shall not permit any deviations from plans and specifications.

I understand that I will be required to remove and replace at no additional cost to the owner any item found to be inconsistent with or not meet the requirements of the contract documents.

The undersigned states that the above is true to the best of his knowledge and that he has the authority to legally bind his firm to the above terms. Failure to provide a legally binding signature shall void submittal.

Electrical Contractor:

By: _____ Date:
Title:
Company:

General Contractor:

By: _____ Date:
Title:
Company:

END OF SECTION 16050

SECTION 16060 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- 1. This Section includes methods and materials for grounding systems and equipment.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
 - 1. Ground rods.
 - 2. Grounding arrangements and connections for separately derived systems.
 - 3. Grounding for sensitive electronic equipment.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:
 - 1. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems based on NFPA 70B.
 - a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
 - b. Include recommended testing intervals.

1.4 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 UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 5. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad 3/4 inch by 10 feet in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Underground Grounding Conductors: Install bare copper conductor, No. 3/0 AWG minimum.
 - 1. Bury at least 24 inches below grade.
 - 2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.
- B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus on insulated spacers 1 inch minimum, from wall 6 inches above finished floor, unless otherwise indicated.

2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
2. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 3. Use exothermic-welded connectors for indoor and outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

END OF SECTION 16060

SECTION 16072 - ELECTRICAL SUPPORTS AND SEISMIC RESTRAINTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Seismic restraints for electrical equipment and systems.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IBC: International Building Code.
- C. IMC: Intermediate metal conduit.
- D. RMC: Rigid metal conduit.
- E. SBC: Standard Building Code.
- F. Seismic Restraint: A structural support element such as a metal framing member, a cable, an anchor bolt or stud, a fastening device, or an assembly of these items used to transmit seismic forces from an item of equipment or system to building structure and to limit movement of item during a seismic event.

1.4 SUBMITTALS

- A. Product Data: Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of electrical support and seismic-restraint component used.
 - 1. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
 - 2. Annotate to indicate application of each product submitted and compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

- B. Testing of Seismic Anchorage Devices: Comply with testing requirements in Part 3 and in Division 16 Section "Electrical Supports and Seismic Restraints."
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 PROJECT CONDITIONS

- A. Site Class as Defined in the IBC: **C**
- B. Assigned Seismic Use Group or Building Category as Defined in the IBC: **II**.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project, with a minimum structural safety factor of five times the applied force.
- B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly.
 - 1. Manufacturers:
 - a. Cooper B-Line; a division of Cooper Industries.
 - b. Thomas & Betts Corporation.
 - c. Unistrut; Tyco International, Ltd.
 - 2. Finishes:
 - a. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3.
 - b. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-3.
 - c. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-3.
 - 3. Channel Dimensions: Selected for structural loading and applicable seismic forces.
- C. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch-diameter holes at a maximum of 8 inches o.c., in at least 1 surface.

1. Manufacturers:
 - a. Allied Support Systems; Aickinstrut Unit.
 - b. Cooper B-Line; a division of Cooper Industries.
 - c. Fabco Plastics Wholesale Limited.
 2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
 3. Fitting and Accessory Materials: Same as channels and angles
 4. Rated Strength: Selected to suit structural loading and applicable seismic forces.
- D. Raceway and Cable Supports: As described in NECA 1.
- E. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- F. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers:
 - 1) Hilti, Inc.
 - 2) ITW Construction Products.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co. Inc.
 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Manufacturers:
 - 1) Cooper B-Line; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc
 - 3) Hilti, Inc.
 - 4) ITW Construction Products.
 - 5) MKT Fastening, LLC.
 - 6) Powers Fasteners.
 3. Concrete Inserts: Steel or malleable-iron slotted-support-system units similar to MSS Type 18; complying with MFMA-3 or MSS SP-58.
 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 5. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
 6. Toggle Bolts: All-steel springhead type.
 7. Hanger Rods: Threaded steel.

2.3 SEISMIC-RESTRAINT COMPONENTS

- A. Rated Strength, Features, and Application Requirements for Restraint Components: As defined in reports by an agency acceptable to authorities having jurisdiction.
 - 1. Structural Safety Factor: Strength in tension, shear, and pullout force of components used shall be at least five times the maximum seismic forces to which they will be subjected.
- B. Angle and Channel-Type Brace Assemblies: Steel angles or steel slotted-support-system components; with accessories for attachment to braced component at one end and to building structure at the other end.
- C. Cable Restraints: ASTM A 603, zinc-coated, steel wire rope attached to steel or stainless-steel thimbles, brackets, swivels, and bolts designed for restraining cable service.
 - 1. Manufacturers:
 - a. Amber/Booth Company, Inc.
 - b. Loos & Co., Inc.
 - c. Mason Industries, Inc.
 - 2. Seismic Mountings, Anchors, and Attachments: Devices as specified in Part 2 "Support, Anchorage, and Attachment Components" Article, selected to resist seismic forces.
 - 3. Hanger Rod Stiffener: Steel tube or reinforcing steel angle clamped to hanger rod, of design recognized by an agency acceptable to authorities having jurisdiction.
 - 4. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to type and size of anchor bolts and studs used.
 - 5. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to type and size of attachment devices used.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 for application of hangers and supports for electrical equipment and systems, except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
 - 2. Secure raceways and cables to these supports with two-bolt conduit clamps **[single-bolt conduit clamps using spring friction action for retention in support channel shall not be used].**

D. Spring-steel clamps shall not be used for supporting conduits.

3.2 SUPPORT AND SEISMIC-RESTRAINT INSTALLATION

- A. Comply with NECA 1 for installation requirements, except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Install seismic-restraint components using methods approved by the evaluation service providing required submittals for component.
- D. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To New Concrete: Bolt to concrete inserts.
 - 2. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 3. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 - 4. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts or beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69
 - 5. To Light Steel: Sheet metal screws.
 - 6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate
- F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF SEISMIC-RESTRAINT COMPONENTS

- A. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- C. Restraint Cables: Provide slack within maximums recommended by manufacturer.
- D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Make flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross expansion and seismic-control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to electrical equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing: Test pullout resistance of seismic anchorage devices.
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 - 5. Test to 90 percent of rated proof load of device.
 - 6. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- C. Record test results.

END OF SECTION 16072

SECTION 16075 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Identification for raceway.
 - 2. Identification for conductors and communication and control cable.
 - 3. Underground-line warning tape.
 - 4. Warning labels and signs.
 - 5. Instruction signs.
 - 6. Equipment identification labels.
 - 7. Miscellaneous identification products.

1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.
- C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

2.2 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
 - 1. Not less than 6 inches wide by 4 mils thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend shall indicate type of underground line.

2.3 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches .
- D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.
- E. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES"

2.4 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.5 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).
- B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
 1. Minimum Width: 3/16 inch .
 2. Tensile Strength: 50 lb minimum.
 3. Temperature Range: Minus 40 to plus 185 deg F
 4. Color: Black, except where used for color-coding.
- B. Paint: Paint materials and application requirements are specified in Division 9 painting Sections.
- C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Power-Circuit Conductor Identification: For conductors in pull and junction boxes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
- B. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape Identify each ungrounded conductor according to source and circuit number.
- C. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- D. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply baked-enamel warning signs. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
 1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:

- a. Power transfer switches.
 - b. Controls with external control power connections.
2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- E. Instruction Signs:
1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
 2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.
- F. Labeling
- A. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
- B. System Painting of exposed conduits, supports, boxes, etc. shall be performed under other sections of this contract. Painting for system identification shall be performed by this contractor. All outlet boxes exposed or accessible thru removable ceiling panels, shall be painted and marked:
- | | | |
|--------------|-----------|----------|
| Normal Power | unpainted | mark "#" |
|--------------|-----------|----------|
- where "#" is the appropriate circuit designation or zone number.
1. Labeling Instructions:
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on 1-1/2-inch high label; where 2 lines of text are required, use labels 2 inches high.
 - b. Outdoor Equipment: Stenciled legend 4 inches high.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 2. Equipment to Be Labeled:
 - a. Panelboards, electrical cabinets, and enclosures.
 - b. Access doors and panels for concealed electrical items.
 - c. Disconnect switches.
 - d. Enclosed circuit breakers.

3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. Color-Coding for Phase Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - 1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.
- I. Painted Identification: Prepare surface and apply paint according to Division 9 painting Sections.

END OF SECTION 16075

SECTION 16120 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
 - 3. Sleeves and sleeve seals for cables.
- B. Related Sections include the following:
 - 1. Division 16 Section "Voice and Data Communication Cabling" for cabling used for voice and data circuits.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.
- C. Field quality-control test reports.
- D. 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.
- E. Comply with NFPA 70.

1.5 COORDINATION

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alcan Products Corporation; Alcan Cable Division.
 - 2. American Insulated Wire Corp.; a Leviton Company.
 - 3. General Cable Corporation.
 - 4. Senator Wire & Cable Company.
 - 5. Southwire Company.
- B. Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THW and THHN-THWN
- D. Multiconductor Cable: Shall not be used on this project.

2.2 CONNECTORS AND SPLICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Hubbell Power Systems, Inc.
 - 3. O-Z/Gedney; EGS Electrical Group LLC.
 - 4. 3M; Electrical Products Division.
 - 5. Tyco Electronics Corp.
- C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum **0.138-inch** thickness as indicated and of length to suit application.
- C. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

2.4 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide the product by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. Calpico, Inc.
 - 3. Metraflex Co.
 - 4. Pipeline Seal and Insulator, Inc.
 - 5. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 6. Pressure Plates: Carbon steel. Include two for each sealing element.
 - 7. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.
- C. "Factory Whips" may be used to connect the light fixtures. Wiring shall be run from J-box to fixture and shall NOT be run from fixture to fixture. Maximum length shall not exceed 6'0".

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-THWN, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: [Type THHN-THWN, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- I. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- J. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 16 Section "Electrical Supports and Seismic Restraints."
- F. Identify and color-code conductors and cables according to Division 16 Section "Electrical Identification."

3.4 CONNECTIONS

- A. 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.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors. Splices shall only occur in a dedicated pull box with no other feeders/cables pulled inside or through this box. For branch circuit boxes – A maximum of three conductors shall be spliced in any junction box.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

Provide an 8" long pigtail connection for phase, neutral and ground connections. Do not "through wire devices". Connections to devices shall be made on SCREW TERMINALS not to push-in slots.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
 - 1. For sleeve rectangle perimeter less than 50 inches and no side greater than 16 inches , thickness shall be 0.052 inch .
 - 2. For sleeve rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch .
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both wall surfaces.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 7 Section "Joint Sealants."
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 7 Section "Through-Penetration Firestop Systems."
- L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.
- M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground exterior-wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in

annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 7 Section "Through-Penetration Firestop Systems."

END OF SECTION 16120

SECTION 16130 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 16 Section "Electrical Supports and Seismic Restraints." Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event

1.5 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 NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Alflex Inc.
 - 3. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 5. Electri-Flex Co.
 - 6. Manhattan/CDT/Cole-Flex.
 - 7. Maverick Tube Corporation.
 - 8. O-Z Gedney; a unit of General Signal.
 - 9. Wheatland Tube Company.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. IMC: ANSI C80.6.
- D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit or IMC.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch minimum.
- E. EMT: ANSI C80.3.
- F. FMC: Zinc-coated steel.
- G. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
 - 2. Fittings for EMT, IMC, Rigid Steel Conduit: compression type.
 - 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch with overlapping sleeves protecting threaded joints.
- H. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 3. Arnco Corporation.
 - 4. CANTEX Inc.
 - 5. CertainTeed Corp.; Pipe & Plastics Group.
 - 6. Condux International, Inc.
 - 7. ElecSYS, Inc.
 - 8. Electri-Flex Co.
 - 9. Lamson & Sessions; Carlon Electrical Products.
 - 10. Manhattan/CDT/Cole-Flex.
 - 11. RACO; a Hubbell Company.
 - 12. Thomas & Betts Corporation.
- B. RNC: NEMA TC 2, Type EPC-40-PVC unless otherwise indicated.
- C. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

2.3 METAL WIREWAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hoffman.
 - 3. Square D; Schneider Electric.
- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type.
- E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hoffman.
 - 2. Lamson & Sessions; Carlon Electrical Products.
- B. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.

- C. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.
- D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. EGS/Appleton Electric.
 - 3. Erickson Electrical Equipment Company.
 - 4. Hoffman.
 - 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
 - 6. O-Z/Gedney; a unit of General Signal.
 - 7. RACO; a Hubbell Company.
 - 8. Robroy Industries, Inc.; Enclosure Division.
 - 9. Scott Fetzer Co.; Adalet Division.
 - 10. Spring City Electrical Manufacturing Company.
 - 11. Thomas & Betts Corporation.
 - 12. Walker Systems, Inc.; Wiremold Company (The).
 - 13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- E. Metal Floor Boxes: Cast metal fully adjustable rectangular.
- F. Nonmetallic Floor Boxes: Nonadjustable, round.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized with gasketed cover.
- I. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures: Plastic
- J. Cabinets:
 - 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.

2.6 SLEEVES FOR RACEWAYS

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

2.7 SLEEVE SEALS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product:
 - 1. Advance Products & Systems, Inc.
 - 2. Calpico, Inc.
 - 3. Metraflex Co.
 - 4. Pipeline Seal and Insulator, Inc.
- D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
 - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 2. Pressure Plates: Carbon steel. Include two for each sealing element.
 - 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed Conduit: Rigid steel conduit, IMC.
 - 2. Concealed Conduit, Aboveground: Rigid steel conduit, IMC, EMT.
 - 3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
 - 4. Connection to Vibrating Equipment Including Transformers and Hydraulic, Pneumatic, HVAC & Plumbing Equipment, Electric Solenoid, or Motor-Driven Equipment: LFMC
 - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

- B. Comply with the following indoor applications, unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit, IMC. Includes raceways in the following locations:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC
 6. Damp or Wet Locations: Rigid steel conduit or IMC.
 7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
 8. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.
 9. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.
 10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, nonmetallic in damp or wet locations.
- C. Minimum Raceway Size: 1/2-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use compression rigid steel conduit fittings, unless otherwise indicated.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.
- E. Maintain a minimum of 4" separation between conduits of different systems.
- F. Conduits shall be installed parallel with or perpendicular to the building architectural and structural construction. Maintain conduit runs as straight and direct as possible. Limit each bend to 90 degrees. Limit the bend radius to a minimum of 6 times the conduit diameter for low voltage conductors, 10 times the conduit diameter for telephone and data lines.
- G. No conduits shall be run horizontally in a wall.
- H. No conduits shall be run between the roof decking and the structure.
- I. No conduits shall be supported from adjacent conduits. Furnish and install trapeze type hangers using 1/4" threaded rod and steel channel for horizontal runs. No conduits shall be supported from the ceiling suspension cables.
- J. A junction box supported from the structure shall not be used to support the attaching conduits. Additional trapeze type hangers using 1/4" threaded rod and steel channel shall be used to support the conduit.
- K. Conduits shall be supported a minimum of every ten feet, at every 90 degree bend and within one foot of every conduit coupling.

- L. A conduit penetration through a wall shall not be used to support the conduit. Additional trapeze type hangers using 1/4" threaded rod and steel channel shall be used to support the conduit.
- M. No conduit penetration through the HVAC platform.
- N. Do not run conduits on the exterior of the building between the brick and the block.
- O. Fire Proofing is not allowed to be installed on any conduits or boxes.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. 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.
- C. Complete raceway installation before starting conductor installation. Provide cast metal boxes where surface mounted in wet locations or dry locations.
- D. Support raceways as specified in Division 16 Section "Electrical Supports and Seismic Restraints."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- I. Set metal floor boxes level and flush with finished floor surface.
- J. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- T. Branch circuits for lighting and general purpose receptacles may be combined up to a maximum of three phase (must be of different phases) and one neutral conductor. Homeruns shall be run directly into panelboard or equipment cabinet and shall not be collected in junction boxes or wireways. Feeders shall not be combined in common raceways.
- U. All data/security system conduits should be fire sealed by this contractor after the owner furnished cabling is installed. Furnish and install an insulation bushing on the end off all data conduits stubbed out to the cable tray.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Contractor will give Architect a three days notice for all site observations. Observation will be required for all under floor conduit, service feeder and grounding installations. Request for site observations shall be submitted in writing to the Architect.

B. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Encase underground PVC conduits, where used for service entrance conductors, with a 24" thick concrete jacket (top sides and bottom). Prepare trench bottom as specified in Division 2 Section "Earthwork" for pipe less than 6 inches in nominal diameter. Conduits shall be supported and racked with manufacturer's conduit supports (No field made supports allowed).
2. Install backfill as specified in Division 2 Section "Earthwork."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 2 Section "Earthwork."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
6. Warning Tape: Bury warning tape approximately 12 inches above direct-buried conduits, placing them 24 inches o.c. Align along the width and along the centerline of conduit.

C. Feeder Conduits Run Beneath Building Slab:

1. Excavate trench bottom to provide firm and uniform support for conduit. Encase underground PVC conduits with a 6" thick concrete jacket (top sides and bottom). Prepare trench bottom as specified in Division 2 Section "Earthwork" for pipe less than 6 inches in nominal diameter. Conduits shall be supported and racked with manufacturer's conduit supports (No field made supports allowed). Conduits to be run a minimum of 36" below the finished slab.
2. Install backfill as specified in Division 2 Section "Earthwork."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 2 Section "Earthwork."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

6. Warning Tape: Bury warning tape approximately 12 inches above direct-buried conduits, placing them 24 inches o.c. Align along the width and along the centerline of conduit.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
 1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F.

Cut Extend wall sleeves **2 inches** on both sides of the wall.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 7 Section "Through-Penetration Firestop Systems."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.5 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Through-Penetration Firestop Systems."

3.7 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of FinalCompletion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 16130

SECTION 16140 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Twist-locking receptacles.
 - 3. Isolated-ground receptacles.
 - 4. Cord and plug sets.
 - 5. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

- B. 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.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5351 (single), 5352 (duplex).
 - b. Hubbell; HBL5351 (single), CR5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, **NON-feed** through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; GF20.
 - b. Pass & Seymour; 2084.
 - c. Hubbell
 - d. Leviton

2.4 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; L520R.
 - b. Hubbell; HBL2310.
 - c. Leviton; 2310.
 - d. Pass & Seymour; L520-R.

2.5 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 - 1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
 - 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.6 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Jumbo stainless steel coverplates.
 - 3. Material for Unfinished Spaces: [Jumbo stainless steel coverplates].
 - 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant die-cast aluminum with lockable cover.

2.7 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
 - 1. Wiring Devices Connected to Normal Power System: As selected by Architect color, unless otherwise indicated or required by NFPA 70 or device listing.
 - 2. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

PART 3 -

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

3.2 IDENTIFICATION

- A. Comply with Division 16 Section "Electrical Identification."

3.3 FIELD QUALITY CONTROL

- A. Tests for Convenience Receptacles:
 - 1. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 2. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 3. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 4. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 16140

SECTION 16145 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. 0-10V LED control switches.
- B. Related Sections include the following:
 - 1. Division 16 Section "Wiring Devices" for wall-box dimmers, and manual light switches.

1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
 - 1. Interconnection diagrams showing field-installed wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 16 Section "Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 16 Section "Conductors and Cables."

2.2 LED 0-10v Dimmer:

Lutron Diva single pole, 120v – 277v, 8a load DVSTV series, Switch and plate color as selected by Architect or equal by Leviton. Submit wiring diagram for 0-10V diming switch. All devices shall be by the same manufacturer.

PART 3 - EXECUTION

3.1 CONTACTOR INSTALLATION

- A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 16 Section "Conductors and Cables." Minimum conduit size shall be 1/2 inch
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 16 Section "Electrical Identification."

1. Identify controlled circuits in lighting contactors.
- B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION 16145

SECTION 16410 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
 - 1. Molded-case circuit breakers.
 - 2. Molded-case switches.
 - 3. Enclosures.

1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. HD: Heavy duty.
- C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current rating.
 - 4. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Manufacturer Seismic Qualification Certification: Submit certification that enclosed switches and circuit breakers, accessories, and components will withstand seismic forces defined in Division 16 Section "Electrical Supports and Seismic Restraints." Include the following:
 - 1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control test reports including the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Manufacturer's field service report.

F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Closeout Procedures" and "Operation and Maintenance Data" include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current curves, including selectable ranges for each type of circuit breaker.

1.5 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 NFPA 70.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F
 2. Altitude: Not exceeding 6600 feet .

1.7 COORDINATION

- A. Coordinate layout and installation of switches, 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

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

- A. Manufacturers:
1. Eaton Corporation; Cutler-Hammer Products.
 2. General Electric Co.; Electrical Distribution & Control Division.
 3. Siemens Energy & Automation, Inc.
 4. Square D/Group Schneider.
- B. 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. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. GFCI Circuit Breakers: Single- and two-pole configurations with **5-mA** trip sensitivity.
- C. Molded-Case Circuit-Breaker Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
 2. Lugs: Mechanical style **with compression lug kits** suitable for number, size, trip ratings, and conductor material.
 3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 4. Ground-Fault Protection: **Integrally mounted** relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at **55** percent of rated voltage.
- D. Molded-Case Switches: Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- E. Molded-Case Switch Accessories:
1. Lugs: Mechanical style **with compression lug kits** suitable for number, size, trip ratings, and material of conductors.
 2. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.
 3. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at **55** percent of rated voltage. Provide "dummy" trip unit where required for proper operation.

2.3 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Wet /Damp Indoor/Outdoor Locations: NEMA 250, Type 3R.
2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONCRETE BASES

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
- B. Concrete base is specified in Division 16 Section "Electrical Supports and Seismic Restraints," and concrete materials and installation requirements are specified in Division 3.

3.3 INSTALLATION

- A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.
- C. Comply with mounting and anchoring requirements specified in Division 16 Section "Electrical Supports and Seismic Restraints."
- D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.4 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 16 Section "Electrical Identification."

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, **test, and adjust** field-assembled components and equipment installation, including connections. Report results in writing.

1. Test mounting and anchorage devices according to requirements in Division 16 Section "Electrical Supports and Seismic Restraints."
2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.6 ADJUSTING

- A. Set field-adjustable switches GFI settings and circuit-breaker trip ranges.

3.7 CLEANING

- A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.
- B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 16410

SECTION 16442 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.
 - 3. Transient voltage suppression panelboards.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. RFI: Radio-frequency interference.
- D. SPDT: Single pole, double throw.

1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. The contractor shall prepare dimensioned rough-in drawings (1/2"=1'0" scale) for each equipment room. These drawings shall show all equipment to scale (based on actual equipment purchased) and shall be fully dimensioned.
- C. Shop Drawings: For each panelboard and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of panelboards and overcurrent protective devices.
 - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Power, signal, and control wiring.
- D. Manufacturer Seismic Qualification Certification: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 16 Section "Electrical Supports and Seismic Restraints." Include the following:
1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Field quality-control test reports including the following:
1. Test procedures used.
 2. Test results that comply with requirements.
 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- F. Panelboard Schedules: For installation in panelboards.
- G. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section Closeout Procedures include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 2. Time-current curves, including selectable ranges for each type of overcurrent protective device.
- 1.5 QUALITY ASSURANCE
- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.
 - B. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
 - C. 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.
 - D. Comply with NEMA PB 1.
 - E. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
1. Ambient Temperature: Not exceeding 104 deg F..
 2. Altitude: Not exceeding 6600 feet.

1.7 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Keys: Six spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
 - a. Eaton Corporation; Cutler-Hammer Products.
 - b. General Electric Co.; Electrical Distribution & Protection Div.
 - c. Siemens Energy & Automation, Inc.
 - d. Square D.
 2. Transient Voltage Suppression Panelboards:
 - a. Current Technology.
 - b. Liebert Corporation.
 - c. Eaton Corporation; Cutler-Hammer Products.
 - d. General Electric Co.; Electrical Distribution & Protection Div.
 - e. Siemens Energy & Automation, Inc.
 - f. Square D.

2.2 MANUFACTURED UNITS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 16 Section "Electrical Supports and Seismic Restraints."
 - B. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.
 - 1. Rated for environmental conditions at installed location.
 - a. Wet or Outdoor Locations: NEMA 250, Type 3R .
 - b. Kitchen Areas: NEMA 250, Type 4X stainless steel.
 - 2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 3. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
 - 4. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 - 5. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
 - 6. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
 - C. Phase and Ground Buses:
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
 - 3. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box.
 - 4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
 - D. Conductor Connectors: Suitable for use with conductor material.
 - 1. Main and Neutral Lugs: Mechanical type.
 - 2. Ground Lugs and Bus Configured Terminators: Compression type.
 - 3. Feed-Through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - 4. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
 - E. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
 - F. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.
- 2.3 PANELBOARD SHORT-CIRCUIT RATING
- A. Fully rated to interrupt symmetrical short-circuit current available at terminals.
- 2.4 DISTRIBUTION PANELBOARDS

- A. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- B. Main Overcurrent Protective Devices: Circuit breaker.
- C. Branch Overcurrent Protective Devices:
 - 1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
 - 2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.6 TRANSIENT VOLTAGE SUPPRESSION PANELBOARDS

- A. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- B. Main Overcurrent Devices: Thermal-magnetic circuit breaker.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.
- D. Bus: Copper phase and neutral buses; 200 percent capacity neutral bus and lugs.

2.7 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: UL 489, 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. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. GFCI Circuit Breakers: Single- and two-pole configurations with 5mA trip sensitivity.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
 - 1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 - 3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - 4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
 - 5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second.
 - 6. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.

2.8 ACCESSORY COMPONENTS AND FEATURES

- A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 16 Section "Electrical Supports and Seismic Restraints."
- C. Mount top of trim 74 inches above finished floor, unless otherwise indicated.
- D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Install overcurrent protective devices and controllers.
- F. Install filler plates in unused spaces.
- G. Stub four 1-inch empty conduits from each panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits below slab not on grade.
- H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."
- B. Create a directory to indicate installed circuit loads Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

Fill out (typewritten) the enclosure's circuit directory card upon completion of work. Obtain a copy of the owner supplied room names and numbers and use this information in the directory card for the room numbers for all branch circuits. Refer to the electrical drawing detail sheets for additional information.

- C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

- A. Ground equipment according to Division 16 Section "Grounding and Bonding."
- B. Connect wiring according to Division 16 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.

- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. 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.

END OF SECTION 16442

SECTION 16511 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Interior lighting fixtures, lamps, and ballasts.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Lighting fixture supports.
- B. Related Sections include the following:
 - 1. Division 16 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.
 - 2. Division 16 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, and multipole lighting relays and contactors.

1.3 DEFINITIONS

- A. BF: Ballast factor.
- B. CRI: Color-rendering index.
- C. HID: High-intensity discharge.
- D. LER: Luminaire efficacy rating.
- E. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of lighting fixture including dimensions.
 - 2. Emergency lighting units including battery and charger.
 - 3. Ballast.
 - 4. Energy-efficiency data.
 - 5. Life, output, and energy-efficiency data for lamps.
 - 6. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

- a. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.
- B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
 - 1. Wiring Diagrams: Power and control wiring.
- C. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.
- D. Qualification Data: For agencies providing photometric data for lighting fixtures.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
- G. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. 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.
- C. Comply with NFPA 70.
- D. FMG Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.
- E. Mockups: Provide interior lighting fixtures for typical classroom mockups complete with power and control connections.
 - 1. Obtain Architect's approval of fixtures for mockups before starting installations.
 - 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Final Completion.

1.6 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

- A. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Electronic Ballasts: Five years from date of Final Completion.
- B. Special Warranty for T5 and T8 Fluorescent Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 - 1. Warranty Period: One year(s) from date of Final Completion.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 3. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Incandescent Fixtures: Comply with UL 1598.
- C. Fluorescent Fixtures: Comply with UL 1598. .
- D. HID Fixtures: Comply with UL 1598. .
- E. Metal Parts: Free of burrs and sharp corners and edges.
- F. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

- G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
 - 4. Laminated Silver Metallized Film: 90 percent.
- I. Plastic Diffusers, Covers, and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: A19 lens minimum unless different thickness is indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass, unless otherwise indicated.

2.3 EXIT SIGNS

- A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 - 1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.

2.4 FLUORESCENT LAMPS

- A. T8 rapid-startlamps, rated 32 W maximum, nominal length of 48 inches, 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours, unless otherwise indicated.
- B. T5 rapid-startlamps, rated 28 W maximum, nominal length of 45.2 inches, 2900 initial lumens (minimum), CRI 85 (minimum), color temperature 3500 K, and average rated life of 20,000 hours, unless otherwise indicated.
- C. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at 3 hours operation per start, unless otherwise indicated.
 - 1. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
 - 2. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
 - 3. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).

2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 16 Section "Electrical Supports and Seismic Restraints" for channel- and angle-iron supports and nonmetallic channel and angle supports.

- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.
- E. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element and the following:
 - 1. Install a minimum of two ceiling support system wires for each fixture. Connect to the lighting fixture diagonal corners. Wire shall have breaking strength of the weight of fixture at a safety factor of 3
 - 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
- C. Suspended Lighting Fixture Support:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
- D. Adjust aimable lighting fixtures to provide required light intensities.
- E. Connect wiring according to Division 16 Section "Conductors and Cables."
- F. Each fixture shall be designed to mount in the type of ceiling in which it is being installed (i.e. plaster, grid, concealed spline, sloped, etc.). Each lighting fixture shall be UL labeled for proper operation in the type of ceiling construction and for the mounting arrangement on/in which it is installed. Where similar fixtures or a family of similar fixtures are specified obtain form one manufacturer.
- G. Field verify ceiling slope for fixtures installed in sloped ceilings and dimensions for any custom fabricated fixture.

3.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 16511