

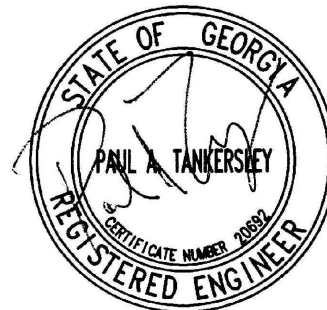


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Dalton, GA 30721  
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A New Classroom Addition for:  
**DAVIS ELEMENTARY SCHOOL**  
5491 HIGHWAY 301, TRENTON GA 30752  
**DADE COUNTY SCHOOLS**

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JOB NO.: 23-031

DATE ISSUED: 11/07/23

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## **SECTION 00010 - REQUEST FOR PROPOSALS**

THE DADE COUNTY, 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 Classroom Addition for Davis Elementary School”, located at 5491 Highway 301 Trenton, GA 30752 (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. In general, the successful contractor will be required to construct a new 8,697 SF classroom wing along with all sitework, utilities, drives, etc., all in accordance with the Contract Documents.

Contractors interested in submitting Proposals must procure a complete set of the Contract Documents from Dade County School District website <https://www.dadecountyschools.org/departments-programs/finance/requests-for-proposals> **All addendum, including answers to contractor’s questions, will be posted to the website.** The Board reserves the right to make available other relevant documents or information concerning the Project.

All 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 February 1, 2024, at 10:00 a.m. at the Project Site. Arrive early and check in at the front office. Any contractor arriving more than 5 minutes late will not be permitted to attend.**

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. For any work requiring a specialty or professional license, only licensed subcontractors may be submitted for consideration. The Board in its evaluation of Proposals will rely upon a contractor’s identification of proposed subcontractors.

In evaluating Proposals, the Board may seek additional information from any contractor concerning such contractor’s Proposal or its proposed subcontractors’ qualifications to construct the Project.

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, take into consideration the following evaluation factors which are listed below:

- A. General Background / Firm History (5 Points)
- B. Financial Status and Bonding (5 Points)
- C. Proposed Project Personnel (15 Points)

- D. Company Experience (25 Points)
- E. Legal Proceedings (5 Points)
- F. Project Specific Approach (10 Points)
- G. Project Specific / Company Safety Plan. (5 Points)
- H. The Contractor's proposed lump sum fee (25 Points).
- I. The completeness and accuracy of proposal. (5 Points)

All Proposals must be properly signed, submitted in duplicate bound notebooks and received by the Board at its Central Office located at **52 Tradition Lane, Trenton, Georgia 30752, no later than 2:00 p.m. on February 15, 2024.** A total of **2** proposals in bound notebooks are required. The Board will receive such Proposals at such time and place. Proposals received 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.

Please note: All allowances included on the Proposal form shall be used only as directed by the Owner and Architect for additional work that is not already included in the contract documents. The Owner will assume full control of these funds throughout the project. At the conclusion of the project, the contract value will be reduced by the amount of any unused allowances.

Contractors are responsible for ensuring Proposals comply with Georgia law, including but not limited to all state and local laws, rules, regulations, ordinances, and policies. 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 Instructions 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.

Contractor must have minimum Worker's Comp and General Liability Insurance in full force and effect. No proposal will be considered unless it is accompanied by satisfactory evidence that the Bidder holds any and all necessary or required Federal, State or local licenses and/or permits. Pursuant to O.C.G.A. § 13-10-91, all contractors and sub-contractors performing work within the State of Georgia on a contract with a public employer must register and participate in a federal work authorization. The Board will require certification for contractor that this requirement has been met. Each Respondent shall submit with its proposal a copy of current Business License &/or Occupational Tax Certificate issued in the state it resides. If bidder cannot provide this License, it will be required to obtain one from the City of Trenton if it is the Awarded Respondent.

DADE COUNTY, GEORGIA, - BOARD OF EDUCATION

## **SECTION 00030 CONTRACTOR'S QUALIFICATIONS / INSTRUCTIONS**

**NAME OF PROJECT: RENOVATIONS TO DAWNVILLE ELEMENTARY SCHOOL**

**NAME OF BOARD: DADE COUNTY SCHOOLS, BOARD OF EDUCATION**

THE DADE COUNTY, 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 Classroom Addition for Davis Elementary School", located at 5491 Highway 301 Trenton, GA 30752 (the "Project").

### **INSTRUCTIONS**

- (1). The Owner, the Dade County Schools, Board of Education, (hereinafter "Board"), 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, 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 Board.
- (2). 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 Board 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 Board of any subsequent agreement between the Board and the Contractor. The Board shall also have and retain any other remedies provided by law.
- (3). Questions shall be submitted to the office of the Architect in writing and addressed to Matt Parton [mparton@krharchitects.com](mailto:mparton@krharchitects.com). 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. **All addendum, including answers to contractor's questions, will be posted to the Dade County School District website: <https://www.dadecountyschools.org/departments-programs/finance/requests-for-proposals>. The Contractor is solely responsible for obtaining any addenda or further correspondence from the procurement website for this solicitation.**

- (4). 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:
- 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;
  - 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;
  - 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;
  - Any requests for substitution must be accompanied by technical data, including laboratory tests, if applicable, on the proposed substitution;
  - 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;
  - 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' Boards, 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
- (5). 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 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. The response by the Contractor to this request for proposal, and its use by the Contractor, and its use by the Board, shall not give rise to any liability on the part of the Board to the Contractor or any third party or person. 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. 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;
- (6). 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. 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.

- (7). 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
- (8). The following questions are to be answered in full, without exception. Answer all information by attaching tabbed sheets into the contractor's proposal as listed below.

**A. GENERAL BACKGROUND – Include response as Tab “A”**

- 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):
- f. Any additional information about the history of the firm the contractor wishes to include.

**B. FINANCIAL STATUS AND BONDING– Include response as Tab “B”**

- a. Please attach Financial Statements for the past three (3) years for which they are complete. If such statements are not available, please furnish the following information:

1. Last Three Fiscal Years:

- 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 (above) 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 (5) 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 (5) 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 (3) 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 (3) 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.

**C. PROPOSED PROJECT PERSONNEL – Include response as Tab “C”**

List the Name, Qualifications, and background of your proposed management team for this Project. (Include the Names and Addresses of Companies he/she has been affiliated with in the last five (5) years). Include current resumes listing relevant project experience. For purposes of

this factor, the referenced projects are preferred to be no less than \$500,000 and not more than \$5,000,000 in scope. Please identify the person who will serve as the principal point of contact throughout the entire project. Provide the following information for each project along with any additional information that would be useful to demonstrate the qualifications of the proposed personnel.

- a. Project Name and Description
- b. Location
- c. Contract Price
- d. Project Schedule – also include if the project was completed on time.
- e. Construction Delivery Type CM, Design/Build, Design/Bid/Build, etc.
- f. Board Representative (with contact information)
- g. Design Professional (with contact information)

**D. COMPANY EXPERIENCE - SIMILAR PROJECTS - Include response as Tab “D”**

List projects of reasonably similar (K-12) nature, scope, and duration (similar to the Board’s Project) performed by your company in the last ten (10) years. Inclusion of at least five (5) but no more than ten (10) projects is preferred. For purposes of this factor, the referenced projects are preferred to be no less than \$500,000 and not more than \$5,000,000 in scope. Provide the following information for each project along with any additional information that would be useful to demonstrate the Contractor’s Qualifications.

- a. Project Name and Description
- b. Location
- c. Contract Price
- d. Project Schedule – also include if the project was completed on time.
- e. Construction Delivery Type CM, Design/Build, Design/Bid/Build, etc.
- f. Board Representative (with contact information)
- g. Design Professional (with contact information)

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.



**E. LEGAL PROCEEDINGS - Include response as Tab "E"**

a. Arbitrations

List all construction arbitration demands filed by, or against, the Contractor in the last five (5) 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 (5) years, and identify the nature of the claim, the amount in dispute, the parties, and the ultimate resolution of the lawsuit.

c. Other Proceedings

Identify any lawsuits, administrative proceedings, or hearings initiated by the National Labor Relations Board or similar state agency in the past seven (7) years concerning any labor practices of the Contractor. Identify the nature of any proceeding and its ultimate resolution.

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 (7) years. Identify the nature of any proceeding and its ultimate resolution.

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 (7) years. Identify the nature of any proceeding and its ultimate resolution.

Have any criminal proceedings or investigations been brought against the Contractor in the last ten (10) 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)

**F. PROJECT SPECIFIC APPROACH - Include response as Tab "F"**

- a. Provide the Contractor's written approach to the project with a specific emphasis on scheduling. This document must include a detailed description of the contractor's approach to the completion of labor intensive or long lead items. The scheduling of supervision and subcontractor work during school hours, in and around an active school site. The Contractor should denote how materials and equipment will be procured and how the project will be staffed with sufficient labor (shifts) and any other means and methods required to complete all work without delay to the project schedule.

**G. COMPANY / PROJECT SPECIFIC SAFETY PLAN - Include response as Tab “G”**

- a. Please describe your company’s approach to project safety.
- b. Please describe your approach to ensure the safety of students, staff and parents throughout this project.

**H. PROPOSAL FORM - Include forms and response as Tab “H”**

- a. All Proposals must be signed by a duly authorized officer, member, or general partner (as appropriate) and dated. All blanks on the Proposal Form, (Exhibit / Tab “H”) 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”.
- b. Please list any additional information that you believe would assist the Board in establishing your company as the most qualified firm for this project.

**I. Tab I – Not used**

**J. AFFIDAVIT - Include forms and response as Tab “J”**

- a. 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 / Tab “J”;

**K. BID BOND - Include forms and response as Tab “K”**

- a. Any Proposal must include a fully executed Bid Bond in the form attached hereto as Exhibit / Tab “L” 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;

End of Section

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

Date :

Re: A New Classroom Addition for Davis Elementary School

Dear Sir/Madam:

In conformity with the Request for Proposals issued by the Dade County, Georgia, 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 \_\_\_\_\_, 20\_\_\_\_.

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 you propose any substitution of subcontractors from those previously identified in your Proposal, please identify such subcontractors, and provide any required Subcontractor's Qualifications Statement and Questionnaire in accordance with the requirements of the Instructions to Proposers.

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 00070 - RESOLUTION**

WHEREAS, THE DADE COUNTY, 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 Classroom Addition for Davis Elementary School", located at 5491 Highway 301 Trenton, GA 30752 (the "Project"). and,

WHEREAS, in accordance with the provisions of O.C.G.A. § 36-91-1, *et. seq.*, the Board issued and duly advertised its Request for Proposals (the "Request") wherein written proposals were requested from contractors interested in constructing the Project; and,

WHEREAS, as required by law, the Request set forth in their order of relative importance the evaluation factors to be utilized by the Board in its selection of a contractor to construct the Project; and,

WHEREAS, in response to the Request, written proposals for construction of the Project have been received by the Board from the following named contractors:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

and,

WHEREAS, in accordance with the Request, and as provided by law, the Board, by and through its authorized representatives, has conducted discussions with each contractor submitting a proposal responsive to the Request; and,

WHEREAS, staff has summarized the proposals of all contractors and has provided the Board of Education with all proposals along with said summary in advance of the Board's meeting; and,

WHEREAS, the Board, has duly and carefully reviewed the proposals received and has applied the evaluation factors in their order of relative importance as set forth in the Request;

NOW, THEREFORE, upon motion duly made and carried, IT IS HEREIN RESOLVED AS FOLLOWS:

Taking into consideration the evaluation factors as set forth in the Request together with staff's summary of criteria and applying said evaluation factors in their order of relative importance, the Board herein finds and determines that the proposal submitted by \_\_\_\_\_ is the most advantageous to the Board for construction of the Project. Attached hereto as Exhibit "A," and incorporated herein by reference, is the Board's evaluation of the proposals received. Said Exhibit sets forth the basis upon which the proposal of \_\_\_\_\_ has been determined to be the most advantageous to the Board.

On the grounds set forth herein, the Board awards the contract for construction of the Project to \_\_\_\_\_.  
This \_\_\_\_ day of \_\_\_\_\_, 20\_\_.

**DADE COUNTY  
BOARD OF EDUCATION**

Dade County School District

By: \_\_\_\_\_  
(Signature) (Date of Execution)

Chairman-DCBOE  
52 Tradition Lane  
Trenton, GA 30752

**SECTION 00080 - PROPOSAL FORM**

**EXHIBIT “H”**

**NAME OF PROJECT:**        **A NEW CLASSROOM ADDITION FOR  
DAVIS ELEMENTARY SCHOOL**

**NAME OF OWNER:**        **DADE COUNTY BOARD OF EDUCATION**

**NAME OF PROPOSED  
CONTRACTOR:**

\_\_\_\_\_  
**(The “Contractor”)**

THE DADE COUNTY, 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 Classroom Addition for Davis Elementary School”, located in Trenton, GA 30752 (the “Project”) This Proposal is submitted in response to the County’s Request for Proposals dated 1/18/2024.

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 11/07/23 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 the work. The liquidated damages to be assessed in the event of unexcused delay in achieving Substantial Completion are \$ 500.00 per calendar day. The liquidated damages to assessed in the event of unexcused 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	\$ _____
Earthwork and Civil	\$ _____
Concrete Foundation and Slabs	\$ _____
Structural Steel	\$ _____
Fire Alarm System	\$ _____
Electrical	\$ _____
Mechanical	\$ _____
Plumbing	\$ _____
Roofing (TPO)	\$ _____
Roofing (Metal)	\$ _____
Masonry	\$ _____
Other	\$ _____
Quantity Allowances (from below)	\$ _____
Lump Sum Allowances	\$ <u>5,000.00</u>
Contingency Allowances	\$ <u>250,000.00</u>
TOTAL (must match lump sum)	\$ _____

**B. Unit Price Proposal (Quantity Allowances)**

The Contractor proposes the following Allowance/Unit prices as described in sections 01020, 01026 and 04200. The total allowance for each item must be calculated from the quantities specified in Section 01020 (entered below) and the contractor's proposed Unit Price. Please reference section 01020 for complete description of work for each item.

<u>Item #</u>	<u>Description</u>	<u>Allowance Qty.</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total Allowance</u>
1.	Remove and dispose of mass rock off site.	<u>50</u>	C.Y.	\$ <u>          </u>	\$ <u>          </u>
2.	Remove and dispose of trench, rock off site.	<u>50</u>	C.Y.	\$ <u>          </u>	\$ <u>          </u>
3.	Remove and dispose of unsuitable soil off site.	<u>100</u>	C.Y.	\$ <u>          </u>	\$ <u>          </u>
4.	Haul in and place suitable fill material from off site.	<u>100</u>	C.Y.	\$ <u>          </u>	\$ <u>          </u>
5.	Haul in and place #4 stone	<u>30</u>	C.Y.	\$ <u>          </u>	\$ <u>          </u>
6.	Haul in and place #57 stone	<u>30</u>	C.Y.	\$ <u>          </u>	\$ <u>          </u>
7.	Haul in and place Rip Rap	<u>10</u>	C.Y.	\$ <u>          </u>	\$ <u>          </u>
8.	Furnish and install Tensar BX 1100 Geogrid or approved equal.	<u>50</u>	S.Y.	\$ <u>          </u>	\$ <u>          </u>
9.	Haul in and place graded aggregate base (GAB).	<u>50</u>	C.Y.	\$ <u>          </u>	\$ <u>          </u>
10.	Furnish and install Trench Drain.	<u>50</u>	L.F.	\$ <u>          </u>	\$ <u>          </u>
11.	Brick	<u>          </u>		\$1,000 per 1000	\$ <u>          </u>
		Enter Quantity			
<b><u>TOTAL QUANTITY ALLOWANCES</u></b>					<b>\$ <u>          </u></b>

**C. Lump Sum Allowances:**

- |    |  |                    |
|----|--|--------------------|
| 1. | <u>Install Backflow Preventer on Water Meter at Hwy. 301</u> | <u>\$ 5,000.00</u> |
|----|--|--------------------|

**D. Contingency Allowances:**

- |    |                              |                      |
|----|------------------------------|----------------------|
| 1. | <u>Contingency Allowance</u> | <u>\$ 250,000.00</u> |
|----|------------------------------|----------------------|

	<u>TOTAL CONTINGENCY ALLOWANCES</u>	<u>\$ 250,000.00</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. Calculation of the brick allowance is the sole responsibility of the contractor. No consideration will be given for additional funds due to a miscalculation of the number of brick required.

The unit prices set forth herein shall be binding and shall become a part of the contract. The Contractor declares that it understands that the quantities shown, for unit price items, are approximate only and are subject to either increase or decrease, and that should the quantities of any of the items of the work be increased, the Contractor proposes to do the additional work at the unit prices stated herein; and should the quantities be decreased, the unused balance will be deducted from the contractor's lump-sum. The Contractor also understands that payment will be made on the basis of actual quantities at the unit price bid and will make no claim for anticipated profits for any decrease in quantities and that actual quantities will be determined upon completion of the work, at which time adjustment will be made to the contract amount by direct increase or decrease. The unit prices set forth herein include all general conditions, overhead, profit and other compensation of every kind and nature associated with the unit price work.



**E. Alternate Proposals**

Contractor proposes these Alternate Proposals. The lump sum pricing below is to fully implement the work described for each item described in Section 01030 - Alternates. **(The Contractor shall clearly indicate the pricing below by use of the words “Add” or “Deduct” as required)**

**ALTERNATE NO. 1:** Light Fixtures

Add / Deduct \$ \_\_\_\_\_

**ALTERNATE NO. 2:** Gravel Parking Area

Add \$ \_\_\_\_\_

**ALTERNATE NO. 3:** Repave Kitchen Drive

Add \$ \_\_\_\_\_

Attached hereto, and incorporated herein as part of this Proposal, Contractor submits a completed forms and responses as described in section 00030. 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 \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
NOTARY PUBLIC

Commission Expiration:

**FORM OF AGREEMENT**

- A. The contract will be AIA Document A-101-2017 with a lump sum fee, as may be amended or supplemented by the Owner.
- B. The insurance furnished by the Contractor under this Article shall provide coverage in amounts not less than the following:
  - a. Comprehensive or Commercial form General Liability Insurance – Limits of Liability.
    - i. \$2,000,000.00 General Aggregate
    - ii. \$1,000,000.00 Each Occurrence – combined single limit for bodily injury and property damage.
  - b. Business Automobile Liability Insurance – Limits of Liability
    - i. \$1,000,000.00 Each Accident – combined single limit for bodily injury and property damage to include uninsured and underinsured motorist coverage.
  - c. Worker's Compensation limits as required by law with Employers Liability limit of \$1,000,000.00.
  - d. Course of Construction Insurance – 100% of the completed value of the work.
  - e. Any additional insurance required by the State of Georgia for the handling of Asbestos.

**SECTION 00100 - AFFIDAVIT**

**EXHIBIT "J"**

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 Dade County Board of Education (hereinafter "the Board") a project known "A New Classroom Addition for Davis Elementary School", located at 5491 Highway 301 Trenton, GA 30752 (the "Project").

2.

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.

3.

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\_\_\_\_.

\_\_\_\_\_  
Commission Expiration

NOTARY PUBLIC

## 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 DADE  
COUNTY, GEORGIA, 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: “A New  
Classroom Addition for Davis Elementary School”, located at 5491 Highway 301 Trenton, GA 30752 (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  
\_\_\_\_\_, 20\_\_\_\_.

**[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 DADE COUNTY, GEORGIA, BOARD OF EDUCATION  
(hereinafter called the “**Obligee**”) in the amount of \_\_\_\_\_ (\$  
) , lawful money of the United States of America, for the payment whereof 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 “A New  
Classroom Addition for Davis Elementary School”, located at 5491 Highway 301 Trenton, GA 30752 (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 \_\_\_\_\_, 20\_\_\_\_.



**[NAME OF PRINCIPAL]**

BY: \_\_\_\_\_ [Seal]

Witness:

\_\_\_\_\_

Date:

\_\_\_\_\_

**[NAME OF SURETY]**

BY: \_\_\_\_\_ [Seal]

Witness:

\_\_\_\_\_

Date:

\_\_\_\_\_

Approved:

Date: \_\_\_\_\_ BY: \_\_\_\_\_

**[ATTACHED SURETY'S POWER OF ATTORNEY]**

**SECTION 00130 – Bid Bond**

**EXHIBIT “K”**

**NAME OF PROJECT:** A NEW CLASSROOM ADDITION FOR DAVIS ELEMENTARY SCHOOL

**NAME OF OWNER:** THE DADE COUNTY, GEORGIA, BOARD OF EDUCATION

**NAME OF PROPOSED  
CONTRACTOR:**

\_\_\_\_\_  
(The “Contractor”)

**KNOW ALL MEN BY THESE PRESENTS** that

\_\_\_\_\_, as Surety (the “Surety”), and \_\_\_\_\_, as Principal (the “Contractor”) are held and firmly bound unto the Dade County 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 by Contractor of: “A New Classroom Addition for Davis Elementary School”, located at 5491 Highway 301 Trenton, GA 30752 (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 \_\_\_\_\_, 20\_\_\_\_.

**[CONTRACTOR]**

By: \_\_\_\_\_ [SEAL]

\_\_\_\_\_  
Witness

Sworn and subscribed to before me this  
\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
NOTARY PUBLIC  
Commission Expiration:

**[NAME OF SURETY]**

By: \_\_\_\_\_ [SEAL]

\_\_\_\_\_  
Witness

Sworn and subscribed to before me this  
\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
NOTARY PUBLIC  
Commission Expiration:

**[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 12. 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 12 become the fixed Construction Schedule.
  2. If any dates of Items 1 through 5 slide forward, then all subsequent dates for Items 6 through 12 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.....1/18/2024
  2. Preproposal Meeting & Time 10:00 AM.....2/1/2024
  3. Proposal Due Date & Time 2:00 PM.....2/15/2024
  4. Best & Final Offer (at Owner’s Option) Due Date & Time ..TBD
  5. Award of Contract.....2/26/2024
  6. Pre-Construction Conference.....3/5/2024
  7. Receipt of Insurance .....3/5/2024
  8. Notice to Proceed.....3/5/2024
  9. Start of Contract Time .....2/26/2024
  10. Access to existing building .....6/5/2024
  11. Substantial Completion.....4/5/2025
  12. Final Completion .....4/25/2025

End of Section

## **SECTION 01020 - ALLOWANCES**

### **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 administrative and procedural requirements governing allowances.
  - 1. Selected materials and equipment are specified in the Contract Documents by allowances. In some cases, these allowances include installation. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
  - 1. Lump-sum allowances.
  - 2. Quantity allowances.
  - 3. Contingency allowances.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1 Section "Modification Procedures" specifies procedures for submitting and handling Change Orders.
  - 2. Division 1 Section "Quality Control Services" specifies procedures governing the use of allowances for inspection and testing.

#### **1.3 DEFINITIONS**

- A. Suitable soil/materials are soils or materials defined as satisfactory or approved backfill and fill material or granular fill acceptable to the Engineer of Record.
- B. Unsuitable soil/material are soils or material defined as unsatisfactory and/or that are not suitable or appropriate for their intended use as determined by the testing agency or the Engineer of Record.

#### **1.4 SELECTION AND PURCHASE**

- A. At the earliest practical date after award of the Contract, advise the Architect of the date when the final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At the Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by the Architect from the designated supplier.

#### **1.5 SUBMITTALS**

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

- B. Submit invoices or delivery slips to show the actual quantities of materials delivered to the site for use in fulfillment of each allowance.

1.6 ALLOWANCES, GENERAL

- A. Owner reserves the right to use unused portions of Allowances for other Work required by the Project.
  - 1. The Owner or Architect shall direct the Contractor as to the use of any unused Allowances.

1.7 QUANTITY ALLOWANCES

- A. Use quantity allowances as scheduled in this section in conjunction with unit prices as scheduled in Specification Section 01026 – Unit Prices to determine line item values associated with the quantity allowances schedule.
- B. Line items for each quantity allowance scheduled shall be included on the “Schedule of Values” included with application for payments.
- C. Contractors costs associated with these line item values shall include all cost necessary, including but not limited to materials, delivery, installation, insurance, applicable taxes, overhead and profit, labor burden, etc.
- D. Should the quantity allowances be exceeded, change orders authorizing additional quantities shall use the same unit price as scheduled in Specification 01026 – Unit Price for additional cost.
- E. At project closeout, credit all unused allowances remaining in the Schedule of Values to Owner by change order.

1.8 LUMP-SUM ALLOWANCES

- A. Line items for each lump sum allowance scheduled shall be included on the “Schedule of Values” included with the Application for Payment.
- B. Contractor’s costs associated with the utility allowances shall be based on the invoice amount from the utility company plus 7 ½ percent for Contractor’s handling. Contractor shall coordinate work with proper utility company, obtain written cost estimate from the utility company, and have estimate approved by Owner prior to beginning work.
- C. Should the lump sum allowances be exceeded, change orders authorizing additional costs shall be executed using the same basis of the original allowance (utility company invoice plus 7 ½ percent for Contractor’s handling).
- D. At project closeout, credit all unused allowances remaining the Schedule of values to Owner by Change Order.

1.9 CONTINGENCY ALLOWANCES

- A. Use the contingency allowance only as directed by Architect for Owner’s purposes and only by Change Orders that indicate amounts to be charged to the allowance.
- B. Contractor’s overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance and are part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

- C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.
- D. Line items for each contingency allowance scheduled shall be included on the "Schedule of Values" included with applications for payment.
- E. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

## PART 2 - PRODUCTS

### 2.1 PRODUCTS

- A. Back fill and fill materials shall be provided as indicated in Division 2 – Earthwork or as recommended by testing company and approved by the Engineer of Record.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. If unsuitable soils or rock are encountered during the Project, the Project Testing Company and the Engineer of Record shall be notified immediately.

### 3.2 UNSUITABLE SOILS AND ROCK

- A. Removal, disposal and placement of unsuitable soils materials and any rock shall be at the recommendation of the Project's Testing Company and as approved by the Engineer of Record.
  - 1. Remove shall include removal by acceptable methods and equipment of the minimum quantities deemed necessary by the Project's Testing Company.
  - 2. Disposal shall include disposal of materials either on site or off site as indicated. Disposal of materials on site shall be at the direction of the Engineer of Record. Rock materials disposed of on site shall be placed in fill slopes as directed by the Engineer of Record. Disposal of materials off site shall be in accordance with applicable laws and regulations. It shall be the responsibility to dispose of off site materials accordingly.
  - 3. Place shall include obtaining suitable backfill and or fill materials or some obtained from on-site or off-site sources as indicated and placing materials and compacting to Project requirements. Materials obtained from on-site sources shall be obtained from on site locations as directed by the Engineer of Record.
  - 4. **No allowances shall be paid unless all quantities are qualified, quantified and approved by the Projects Testing Company and the Engineer of Record.**

### 3.3 REMOVAL AND RELOCATION OF EXISTING UTILITIES

- A. Removal or relocation of utilities shall be coordinated by the Contractor.

### 3.4 SCHEDULE OF ALLOWANCES:

Note: Allowances and Unit prices are in addition to work already included in the contract documents.

A line item for these allowances shall be included on the "Schedule of Values" included with application for payments.

At project closeout, credit the remaining amount of all allowances in the Schedule of Values to the Owner by change order.

A. Quantity Allowances

1. Include in the base bid an amount to remove and dispose of 50 cubic yards of Mass Rock off site.
2. Include in the base bid an amount to remove and dispose of 50 cubic yards of Trench Rock off site.
3. Include in the base bid an amount to remove and dispose of 100 cubic yards of unsuitable soil off site.
4. Include in the base bid an amount to haul in 100 cubic yards of suitable soil from off-site and compact in-place to replace excavated rock or unsuitable soil.
5. Include in the base bid an amount to haul in and place 30 tons #4 stone
6. Include in the base bid an amount to haul in and place 30 tons of #57 stone.
7. Include in the base bid an amount to haul in and place 10 tons of Rip Rap.
8. Include in the base bid an amount for material and placement of 50 square yards of Tensar BX 1100 Geogrid or approved equal.
9. Include in the base bid an amount to haul in and place 50 cubic yards of compacted graded aggregate base.
10. Include in the Base Bid an amount to furnish and place 50 lineal feet of Trench Drain.
12. Include in the Base bid \$1,500 per 1000 bricks. All calculations for brick quantities are the responsibility of the contractor. See section 04200 Masonry for additional information.

B. Lump Sum Allowances

1. Lump Sum Allowance: Include in the base bid an amount of \$5,000.00 for purchase and installation of a backflow preventer on the water meter at Highway 301.

C. Contingency Allowance

1. General Construction Allowance: Include in the base bid an amount of \$250,000.00 for changes in the scope of work as authorized by the Owner and Architect.



**SECTION 01026 - UNIT PRICES**

**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 administrative and procedural requirements for unit prices.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 2 Section "Earthwork" for requirements and procedures regarding rock excavation.

1.3 DEFINITIONS:

- A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if the estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES:

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, profit, and applicable taxes.
- B. Measurement and Payment: All measurements shall be verified by an on site representative from the Owner's geotechnical testing firm. Refer to individual Specification Section 01020 – Allowances for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in that Section.
- C. Schedule: A "Unit Price Schedule" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials described under each unit price.

**PART 2 - PRODUCTS (Not Applicable)**

**PART 3 - EXECUTION**

3.1 UNIT PRICE SCHEDULE: Reference Section 01020 and 00080

END OF SECTION 01026

## **SECTION 01030 - ALTERNATES**

### **PART 1 - GENERAL**

#### **SUMMARY**

This Section specifies administrative and procedural requirements for Alternates.

**Definition:** An alternate is an amount proposed by Bidders and stated on the Bid Form for certain construction activities defined in the Bidding Requirements that may be added to or deducted from Base Bid amount if the Owner decides to accept a corresponding change in the amount of construction to be completed, or in products, materials, equipment, systems or installation methods described in Contract Documents.

**Coordination:** Coordinate related Work and modify or adjust adjacent Work as necessary to ensure that Work affected by each accepted Alternate is complete and fully integrated into the project.

**Notification:** Immediately following the award of the Contract, prepare and distribute to each party involved, notification of the status of each Alternate. Indicate whether Alternates have been accepted, rejected or deferred for consideration at a later date. Include a complete description of negotiated modifications to Alternates.

**Schedule:** A "Schedule of Alternates" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods necessary to achieve the Work described under each Alternate.

Include as part of each Alternate, miscellaneous devices, accessory objects and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.

#### **SCHEDULE OF ALTERNATES:**

##### **Alternate No. 1**

Provide a proposed price to include all work shown as ALT1 on the Electrical Documents. If the contractor has not included the basis of design in their base bid, include a price to provide basis of design.

##### **Alternate No. 2**

Provide a proposed price to include all work shown as ALT2 on the Civil Documents. This generally includes a new gravel parking area and related work.

##### **Alternate No. 3**

Provide a proposed price to include all work shown as ALT3 on the Civil Documents. This generally includes milling and removing the existing asphalt topping and repaving with new and related work.

END OF SECTION 01030

**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 01250 - CONTRACT MODIFICATION PROCEDURES**

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 specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections include the following:
  - 1. Division 1 Payment Procedures

1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
  - 2. Within 7 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect. Reference Section 00090 for additional instructions.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a detailed list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

#### 1.5 ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, base each Change Order proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
  1. Include installation costs in purchase amount only where indicated as part of the allowance.
  2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit.
  1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
  2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

#### 1.6 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

END OF SECTION 01250

**SECTION 01290 - PAYMENT PROCEDURES**

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 specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Sections include the following:
  - 1. Division 1 Section "Allowances" for procedural requirements governing handling and processing of allowances.
  - 2. Division 1 Section "Unit Prices" for administrative requirements governing use of unit prices.
  - 3. Division 1 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
  - 4. Division 1 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.
  - 5. Division 1 Section "Construction Photograph Documentation" for submittal of photographs with application of payment.

1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
  - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
    - a. Application for Payment forms with Continuation Sheets.
    - b. Submittals Schedule.
    - c. Contractor's Construction Schedule.
  - 2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
    - a. The Schedule of Values must be approved by the Owner/Architect prior to submission of the initial application of payment.
  - 3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.



- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section and additional line for major products as listed in the summary section. See example of pay application at the end of this section.

1. Identification: Include the following Project identification on the Schedule of Values:
  - a. Project name and location.
  - b. Name of Architect.
  - c. Architect's project number.
  - d. Contractor's name and address.
  - e. Date of submittal.
2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
  - a. Related Specification Section or Division.
  - b. Dollar value.
    - 1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
  - a. Any items listed as stored items must be on-site. Include evidence of insurance and invoices.
  - b. **The owner will not pay for material stored off site.**
6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
  - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place must be shown as separate line items in the Schedule of Values.

#### 1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: See Owner/Contractor Agreement.
- D. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment in addition the Georgia Dept. of Education coversheet.
  - 1. The Contractor shall submit with each monthly payment application the Georgia Department of Education Facilities Services Unit Form 0263.
- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
  - 1. Prior to contractor's first application for payment, the schedule of values must reflect the actual values of the subcontractor's contracts. Copies of these contracts will be made available to the architect and owner prior to submitting the first application for payment.
  - 2. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
  - 3. Include amounts of Change Orders and Field Directives issued before last day of construction period covered by application.
- F. Transmittal: Submit 4 (four) signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. All copies shall include waivers of lien and similar attachments if required.
  - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
  - 2. Only one copy will be required as an original AIA Document.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
  - 1. Submit partial waivers on each item for amount requested, before deduction for retainage, on each item.
  - 2. When an application shows completion of an item, submit final or full waivers.
  - 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
    - a. Submit final Application for Payment with or proceeded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
  - 4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.
    - a. See example of a suggestive form at the end of this section.

- H. Onsite Stored Materials: All onsite stored material will need to be submitted as a separate spreadsheet as indicated at the end of this section with each applicable pay application. The Architect will review onsite stored material during the monthly pay application process and determine if material requested for payment is accurate. Again, Owner will not pay for offsite stored material.
- I. Submit Initial Application for Payment: Administrative actions and submittals that must precede and be approved by the Owner and Architect prior to the submittal of first Application for Payment include the following:
1. List of subcontractors.
  2. List of major suppliers and fabricators
  3. Schedule of Values.
  4. Schedule of Unit Prices
  5. Contractor's Construction Schedule (preliminary if not final).
  6. Submittal Schedule.
  7. Schedule of preinstallation conferences.
  8. List of Contractor's staff assignments.
  9. List of Contractor's principal consultants.
  10. Copies of building permits.
  11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
  12. Initial progress report.
  13. Certificates of insurance and insurance policies.
  14. Performance and payment bonds.
  15. Initial settlement survey and damage report if required.
- J. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
  2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work, if applicable.
  3. Administrative actions and submittals that shall proceed or coincide with this application include:
    - a. Occupancy permits and similar approvals.
    - b. Warranties (guarantees) and maintenance agreements.
    - c. Test/adjust/balance records.
    - d. Maintenance instructions.
    - e. Meter readings.
    - f. Start-up performance reports.
    - g. Change-over information, including door lock change over, related to Owner's occupancy, use, operation and maintenance.
    - h. Final cleaning.
    - i. Application for reduction of retainage, and consent of surety.
    - j. Advice on shifting insurance coverage.
    - k. Final progress photographs.
    - l. List of incomplete work, recognized as exceptions to Architect's Certificate of Substantial Completion.
  4. After the Certificate of Substantial Completion has been executed by all parties concerned and before payment is made the Contractor shall submit the following documents:
    - a. Submit CONSENT OF SURETY TO FINAL REDUCTION IN OR PARTIAL RELEASE OF RETAINAGE, A.I.A. Document G707A, if not previously submitted.
- K. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Completion of any contract required training.
3. Completion of Project Closeout Documents.
4. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
5. Updated final statement, accounting for final changes to the Contract Sum.
6. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
7. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
8. AIA Document G707, "Consent of Surety to Final Payment."
9. Evidence that claims have been settled.
10. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
11. Final, liquidated damages settlement statement.
12. Removal of surplus materials, rubbish and similar elements from Owner's property.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01290 (See attached forms)

AFFIDAVIT AND WAIVER OF LIEN

\_\_\_\_\_ being first duly sworn says that he/she makes this affidavit on behalf of \_\_\_\_\_ having entered into an agreement with \_\_\_\_\_, the Owner for \_\_\_\_\_, on the premises of the Owner located at \_\_\_\_\_; that all labor material and services committed for have been fully paid and indebtedness discharged to the date of this affidavit. Furthermore, for and in considerations of \$ \_\_\_\_\_, the undersigned does hereby waive, release and relinquish all claims for right of lien which the undersigned may now have upon the premises above described, for labor and material, general supervision of construction or alteration, and/or otherwise except for claims or right of lien for contract and/or change order work performed to extent that payment is being retained or will subsequently become due.

---

\_\_\_\_\_  
Name of Firm

\_\_\_\_\_  
Name

\_\_\_\_\_  
Title of Officer

Subscribed and Sworn to before me,

This \_\_\_\_\_ day of \_\_\_\_\_

\_\_\_\_\_  
Notary

A	B	C	D	E	F	G		H	I
Item No.	Description of Work	Schedule d of Value	Work Completed		Materials Presently Stored (Not in D or E)	Total Completed & Stored To Date (D + E + F)	% ( C / G )	Balance To Finish (C - G)	Retainage (If Variable Rate)
			From Previous application (D + E)	This Period					
Division 1.00 - General Requirements									
1.01	Supervision								
1.02	OH&P								
1.03	Temporary Utilities								
1.04	Insurance								
1.05	Payment & Performance Bond								
1.06	Engineering/Surveying								
1.07	Safety								
1.08	Office Rental								
1.09	Equipment & Tool (Small) Retail								
1.10	Projection Documentation								
1.11	Daily Clean-up								
1.12	Dump Fee								
1.13	Final Clean								
1.14	Closeouts/As-builts								
1.15	Etc.								
	TOTALS								
Division 2.00 - Sitework									
2.01	Bond								
2.02	Mobilization								
2.03	Submittals/Shop Drawings								

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PAYMENT PROCEDURES

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2.04	Erosion Control BMP's								
2.05	Temporary Ponds								
2.06	Temporary Grassing								
2.07	Slope Matting								
2.08	Clear & Grub								
2.09	Earthwork								
2.10	Construction Entrances								
2.11	Layout & Staking								
2.12	Mass Grading								
2.13	Fine Grade Building Pad								
2.14	Fine Grade Parking Lot								
2.15	SD2's								
2.16	SD3's								
2.17	Retaining Wall								
2.18	Storm Drain Material								
2.19	Storm Drain Install								
2.20	Sanitary Sewer Material								
2.21	Sanitary Sewer Install								
2.22	Site Fire Line Material								
2.23	Site Fire Line Install								
2.24	Domestic Water Material								
2.25	Domestic Water Install								
2.26	Fire Hydrants								
2.27	Heavy Duty Asphalt Paving								
2.28	Light Duty Asphalt Paving								
2.29	Curb & Gutter								
2.30	Striping & Signage								
2.31	Basketball Court Paving								

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PAYMENT PROCEDURES

13-003

2.35	Chain Link Fencing								
2.36	Bollards								
2.37	Landscaping								
2.38	Termite Treatment								
2.39	Etc.								
2.40									
	TOTALS								
Division 3.00 - Concrete									
3.01	Bond								
3.02	Mobilization								
3.03	Submittals/Shop Drawings								
3.04	Concrete Footing (Area A-F)								
3.04a	Concrete Footing - Area A								
3.04b	Concrete Footing - Area B								
3.04c	Etc.								
3.05	Concrete SOG (Area A-K)								
3.06	Concrete Sidewalk								
3.07	Concrete Paving								
3.08	Etc.								
3.09									
	TOTALS								
Division 4.00 - Masonry									
4.01	Bond								
4.02	Mobilization								
4.03	Submittals/Shop Drawings								
4.04	CMU Material (Area A-K)								
4.05	CMU Labor (Area A-K)								
4.06	Splitface Material (Area A-K)								

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4.07	Splitface Labor (Area A-K)								
4.08	CMU & Splitface Accessories								
4.09	Brick Accessories								
4.10	Clean Brick								
4.11	Etc.								
4.12									
	TOTALS								
Division 5.00 - Metals									
5.01	Bond								
5.02	Mobilization								
5.03	Submittals/Shop Drawings								
5.04	Anchor Bolts								
5.05	Embeds								
5.06	Columns & Beams - Material (Area A-K)								
5.07	Columns & Beams - Labor (Area A-K)								
5.08	Joist - Material (Area A-K)								
5.09	Joist - Labor (Area A-K)								
5.10	Steel Decking - Material (Area A-K)								
5.11	Steel Decking - Labor (Area A-K)								
5.12	Trusses - Material (Area A-K)								
5.13	Trusses - Labor (Area A-K)								
5.14	Misc. Metals								
5.15	Stairs & Rails - Material								
5.16	Stairs & Rails - Labor								
5.17	Etc.								
5.18									
	TOTALS								
Division 6.00 - Woods & Plastics									

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6.01	Bond								
6.02	Submittals/Shop Drawings								
6.03	Rough Carpentry								
6.04	Etc.								
6.05									
	TOTALS								
Division 7.00 - Thermal & Moisture Protection									
7.01	Bond								
7.02	Mobilization								
7.03	Submittals/Shop Drawings								
7.04	Waterproofing								
7.05	Damproofing								
7.06	Firestopping								
7.07	Vapor Barrier & Retarder								
7.08	Roof Insulation - Material								
7.09	Roof Insulation - Labor								
7.08	Standing Seam Metal Panels - Material								
7.09	Standing Seam Metal Panels - Labor								
7.10	Wall Panels - Material								
7.11	Wall Panels - Labor								
7.12	Built-up Roof - Material								
7.13	Built-up Roof - Labor								
7.14	Roof Hatch								
7.15	Joint Sealants								
7.16	Etc.								
7.17									
	TOTALS								
Division 8.00 - Doors & Windows									

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8.01	Bond								
8.02	Mobilization								
8.03	Submittals/Shop Drawings								
8.04	HM Doors & Frames (Area A-K)								
8.05	FRP Doors (Area A-K)								
8.06	Traffic Doors (Area A-K)								
8.07	Wood Doors (Area A-K)								
8.08	Finish Hardware (Area A-K)								
8.09	Glass & Glazing (Area A-K)								
8.10	Alum. Entrances & Storefronts								
8.11	Coiling Doors								
8.12	Etc.								
8.13									
	TOTALS								
Division 9.00 - Finishes									
9.01	Bond								
9.02	Mobilization								
9.03	Submittals/Shop Drawings								
9.04	Metal Studs - Exterior (Material)								
9.05	Metal Studs - Interior (Labor)								
9.06	Sheathing - Exterior (Material)								
9.07	Sheathing - Interior (Labor)								
9.08	Insulation - Exterior (Material)								
9.09	Insulation - Interior (Labor)								
9.10	Gypsum Board Walls (Material)								
9.11	Gypsum Board Walls (Labor)								
9.12	Gypsum Board Ceiling (Material)								
9.13	Gypsum Board Ceiling (Labor)								

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9.10	Gypsum Board Finish Walls (Material)								
9.11	Gypsum Board Finish Ceiling								
9.12	Quarry Tile (Material)								
9.13	Quarry Tile (Labor)								
9.14	Acoustical Grid (Material)								
9.15	Acoustical Grid (Labor)								
9.16	Acoustical Tile (Material)								
9.17	Acoustical Tile (Labor)								
9.18	Wood Flooring								
9.19	VCT (Material)								
9.20	VCT (Labor)								
9.21	Resilient Flooring								
9.22	Stair Treads & Rubber Tile								
9.23	Resinous Flooring								
9.24	Polished Concrete Floors								
9.25	Painting								
9.26	Etc.								
9.27									
	TOTALS								
Division 10.00 - Specialties									
10.01	Bond								
10.02	Submittals/Shop Drawings								
10.03	Visual Display Board								
10.04	Toilet Partition & Accessories								
10.05	Metal Lockers								
10.06	Louvers & Vents								
10.07	Flagpole								
10.08	Signage (Exterior)								

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10.09	Signage (Interior)								
10.10	Fire Protection Specialties								
10.11	Prefab Metal Canopy								
10.12	Storage Shelving								
10.13	Toilet & Bath Accessories								
10.10	Etc.								
10.11									
	TOTALS								
Division 11.00 - Equipment									
11.01	Bond								
11.02	Submittals/Shop Drawings								
11.03	Stage Curtain								
11.04	Projector Screen								
11.05	Food Service Equipment (Material)								
11.06	Food Service Equipment (Labor)								
11.07	Walk-in Cooler & Freezer (Material)								
11.08	Walk-in Cooler & Freezer (Labor)								
11.09	Gymnasium Equipment								
11.10	Scoreboards								
11.11	Dock Bumpers								
11.12	Key Vault (Knox Box)								
11.13	Etc.								
11.14									
	TOTALS								
Division 12.00 - Furnishings									
12.01	Bond								
12.02	Submittals/Shop Drawings								
12.03	General Casework								

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12.04	Library Casework								
12.05	Laboratory Casework								
12.06	Window Treatment								
12.07	Telescoping Stands								
12.08	Floor Mats								
12.09	Etc.								
12.10									
	TOTALS								
Division 13.00 - Special Construction									
13.01	Bond								
13.02	Mobilization								
13.03	Submittals/Shop Drawings								
13.04	Fire Suppression Piping (Divide in Zones) - Material								
13.05	Fire Suppression Piping (Divide in Zones) - Labor								
13.06	Etc.								
13.07									
	TOTALS								
Division 14.00 - Conveying Systems									
14.01	Bond								
14.02	Mobilization								
14.03	Submittals/Shop Drawings								
14.04	Elevator								
14.05	Etc.								
14.06									
Division 15.00 - Mechanical									
15.01	Plumbing - Bond								
15.02	Plumbing - Mobilization								

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15.03	Plumbing - Submittals/Shop Drawings								
15.04	Plumbing - Closeouts								
15.05	Plumbing - Testing & Video								
15.06	Plumbing - Underground Rough-in (Material)								
15.07	Plumbing - Underground Rough-in (Labor)								
15.08	Plumbing - Floor Drains / Cleanouts (Material)								
15.09	Plumbing - Floor Drains / Cleanouts (Labor)								
15.10	Plumbing - Roof Drains / Cleanouts (Material)								
15.11	Plumbing - Roof Drains / Cleanouts (Labor)								
15.12	Plumbing - Downspout Boot (Material)								
15.13	Plumbing - Downspout Boot (Labor)								
15.14	Plumbing - Grease Trap (Material)								
15.15	Plumbing - Grease Trap (Labor)								
15.16	Plumbing - Copper Pipe (Material)								
15.17	Plumbing - Copper Pipe (Labor)								
15.18	Plumbing - Overhead Cast Iron Pipe (Material)								
15.19	Plumbing - Overhead Cast Iron Pipe (Labor)								
15.20	Plumbing - Gas Piping (Material)								
15.21	Plumbing - Gas Piping (Labor)								
15.22	Plumbing - Fixtures (Material)								
15.23	Plumbing - Fixtures (Labor)								
15.24	Etc.								
15.25	HVAC - Bond								
15.26	HVAC - Mobilization								
15.27	HVAC - Submittals/Shop Drawings								

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15.28	HVAC - Coordinating Drawings								
15.29	HVAC - Closeouts								
15.30	HVAC - Roof Top Curb (Material)								
15.31	HVAC - Roof Top Curb (Labor)								
15.32	HVAC - Roof Top Unit (Material)								
15.33	HVAC - Roof Top Units (Labor)								
15.34	HVAC - Chiller (Material)								
15.35	HVAC - Chiller (Labor)								
15.36	HVAC - Ionization Unit (Material)								
15.37	HVAC - Ionization Unit (Labor)								
15.38	HVAC - Fan Coil Unit (Material)								
15.39	HVAC - Fan Coil Unit (Labor)								
15.40	HVAC - Gas Unit Heater (Material)								
15.41	HVAC - Gas Unit Heater (Labor)								
15.42	HVAC - Ductless Split Unit (Material)								
15.43	HVAC - Ductless Split Unit (Labor)								
15.44	HVAC - Boiler Permit								
15.45	HVAC - Hot Water Boiler (Material)								
15.46	HVAC - Hot Water Boiler (Labor)								
15.47	HVAC - ERU's (Material)								
15.48	HVAC - ERU's (Labor)								
15.49	HVAC - Condensing Units (Material)								
15.50	HVAC - Condensing Units (Labor)								
15.51	HVAC - Exhaust Fans (Material)								
15.52	HVAC - Exhaust Fans (Labor)								
15.53	HVAC - Range Hood System (Material)								
15.54	HVAC - Range Hood System (Labor)								
15.55	HVAC - Range Hood Fire System								



15.56	HVAC - Grills & Registers (Material)								
15.57	HVAC - Grills & Registers (Labor)								
15.58	HVAC - Ductwork (Material)								
15.59	HVAC - Ductwork (Labor)								
15.60	HVAC - Duct Accessories (etc.)								
15.61	HVAC - Fire/Smoke Dampers (Material)								
15.62	HVAC - Fire/Smoke Dampers (Labor)								
15.63	HVAC - Louvers								
15.64	HVAC - Kiln Hood								
15.65	HVAC - Air Curtain								
15.66	HVAC - Residential range Hood								
15.67	HVAC - Piping/Accessories (Material)								
15.68	HVAC - Piping/Accessories (Labor)								
15.69	HVAC - Piping Identification								
15.70	HVAC - Flow Control Valves								
15.71	HVAC - Vibration Isolation								
15.72	HVAC - Chemical Treatment								
15.73	HVAC - Equipment & Pipe Support (Material)								
15.74	HVAC - Equipment & Pipe Support (Labor)								
15.75	HVAC - Boiler Flues								
15.76	HVAC - VFD's								
15.77	Etc.								
15.78	EMS/Controls - Bond								
15.79	EMS/Controls - Mobilization/Pre-Engineering								
15.80	EMS/Controls - Submittals/Shop Drawings								
15.81	EMS/Controls - Closeouts								
15.82	EMS/Controls - Engineering								

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15.83	EMS/Controls - Modules and Sensors								
15.84	EMS/Controls - Valves and Dampers								
15.85	EMS/Controls - Installation								
15.86	EMS/Controls - Commissioning								
15.87	EMS/Controls - Misc. Filters								
15.88	EMS/Controls - Test and Start								
15.89	Etc.								
	TOTALS								
Division 16.00 - Electrical									
16.01	Bond								
16.02	Mobilization								
16.03	Submittals/Shop Drawings								
16.04	Closeouts								
16.05	Underground Conduit (Material)								
16.06	Underground Conduit (Labor)								
16.07	Underground Wire (Material)								
16.08	Underground Wire (Labor)								
16.09	Conduit / Boxes Rough-in (Wall)								
16.10	Conduit / Boxes Rough-in (Ceiling)								
16.11	Cable Tray (Material)								
16.12	Cable Tray (Labor)								
16.13	Building Wire (Material)								
16.14	Building Wire (Labor)								
16.15	Wiring Devices (Material)								
16.16	Wiring Devices (Labor)								
16.17	Switchboard & Panels (Material)								
16.18	Switchboard & Panels (Labor)								
16.19	Lighting Fixtures (Material) - Area A-K								

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16.20	Lighting Fixtures (Labor) - Area A-K								
16.21	Fire Alarm (Material) - Area A-K								
16.22	Fire Alarm (Labor) - Area A-K								
16.23	Fire Alarm (Test & Certify)								
16.24	Intercom (Material) - Area A-K								
16.25	Intercom (Labor) - Area A-K								
16.26	Cafeteria Sound System (Labor) - Area A-K								
16.27	Cafeteria Sound System (Material) - Area A-K								
16.28	Gymnasium Sound System (Labor) - Area A-K								
16.29	Gymnasium Sound System (Material) - Area A-K								
16.30	Telephone & Computer - Area A-K								
16.31	Generator (Material)								
16.32	Generator (Labor)								
16.33	Etc.								
	TOTALS								
Allowance									
17.01	See Specification								

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# **STORED ONSITE MATERIAL EXAMPLE SUMMARY**

Application No.:

Period From:

Period to:

A	B	C	D	E	F	G
Item No.	Description of Work	Trade (GC or Sub)	Type of Material	Location Stored	Quantity	Cost
5.15	Stairs & Rails - Material	JM Steel	Stair Pans	Stairwell B-2	4	\$7,500
7.08	Roof Insulation - Material	Roof Plus	3" Roof Insulation	Site (Area B)	100% (Area C-D)	\$38,000
8.07	Wood Doors (Area A)	Door Supply Co.	Doors	Science Lab C-25	35	\$25,000
8.08	Finish Hardware (Area A)	Door Supply Co.	Hardware	Job Trailer	50% (Area A)	\$5,400
9.18	Wood Flooring	Smiths Flooring	Gym Floor	Gymnasium	100	\$30,000
15.22	Plumbing - Fixtures (Material)	PJs Plumbing & Son	Sinks	Plumber Trailer	20	\$4,500
15.58	HVAC - Ductwork (Material)	HVAC Industrial	Duct	Classroom B-12	30% (Area F)	\$5,500
<b>Total</b>						<b>\$115,900</b>

**SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION**

**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 administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. General project coordination procedures.
  - 2. Coordination Drawings.
  - 3. Administrative and supervisory personnel.
  - 4. Project meetings.
  - 5. RFI's (Request for Information).
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1 Section "Construction Progress Documentation" for preparing and submitting the Contractor's Construction Schedule.
  - 2. Division 1 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 3. Division 1 Section "Closeout Procedures" for coordinating Contract closeout.

**1.3 DEFINITION**

- A. RFI – Is a request made by the Contractor for further information or clarification during construction.

**1.4 COORDINATION**

- A. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
  - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  - 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
  - 3. Make adequate provisions to accommodate items scheduled for later installation.

4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
  - B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
    1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
  - C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
    1. Preparation of Contractor's Construction Schedule.
    2. Preparation of the Schedule of Values.
    3. Installation and removal of temporary facilities and controls.
    4. Delivery and processing of submittals.
    5. Progress meetings.
    6. Preinstallation conferences.
    7. Start up and adjustment of systems.
    8. Project closeout activities.
    9. Warranty work.
  - D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
    1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work.
  - E. Equipment other than that on which the Drawings are based:
    1. The structural, mechanical and electrical requirements for certain items of equipment are based on a particular manufacturer. However, other manufacturers may have also been approved for use. It shall be the Contractors responsibility to provide for any changes in structural, mechanical, and electrical requirements for equipment other than that on which the Drawings and Specifications are based at no cost to the Owner. The Contractor shall give special attention to coordinating the location of the required electrical connections of equipment and coordinating the ampacity, voltage, and phase characteristics of the equipment furnished with the design ampacity, voltage, and phase of the specific electrical circuit indicated on the shop drawings for this equipment.
  - F. Coordinate with Authority Having Jurisdiction (AHJ).
    1. Contractor shall contact and coordinate with all AHJ's, local and others, for required inspections, fees, etc. These include, but are not limited to, the building Dept, the Fire Marshal's Office, Water and Sewer Authority and the County Engineering Department.
  - G. Coordinate with Owner's testing agency.
    1. Contractor shall coordinate all special inspection testing with the Owner's agent.
- 1.5 SUBMITTALS
- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
  - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
  - b. Indicate required installation sequences.
  - c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
2. Indicate relationship of components shown on separate Shop Drawings.
3. Indicate required installation sequences.
4. Coordination Drawings Prints: Prepare coordination drawings prints in accordance with requirements of Division 1 Section "Submittal Procedures."
5. Refer to Division 15 Section "Basic Mechanical Materials and Methods" and Division 16 Section "Basic Electrical Materials and Methods" for specific Coordination Drawing requirements for mechanical and electrical installations.
6. Review: Architect will review coordination drawings to confirm that the work is being coordinated, but not for the details of the coordination, which are the Contractor's responsibility. If the Architect determines that the coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, the Architect will so inform the Contractor, who shall make changes as directed and resubmit.

#### 1.6 KEY PERSONNEL

- A. Staff Names: Within 15 (fifteen) days of starting construction operations, submit a list of principal staff assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, cellular and office telephone numbers. Provide names, email addresses, business addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
- B. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone.
- C. Update list if changes or additions occur and redistribute.

#### 1.7 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

- A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.
  1. Include special personnel required for coordination of operations with other contractors.

#### 1.8 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
  1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
  2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 (three) days of the meeting.
- B. Preconstruction Conference: See preliminary schedule. Hold the conference at the Office of the Owner. Conduct the meeting to review responsibilities and personnel assignments. The Notice to Proceed will not be issued prior to the pre-construction conference.
1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Phasing.
    - c. Critical work sequencing and long lead items.
    - d. Designation of responsible personnel.
    - e. Procedures for processing field decisions and Change Orders.
    - f. RFI procedures.
    - g. Procedures for processing Applications for Payment.
    - h. Distribution of the Contract Documents.
    - i. Procedures for testing and inspections.
    - j. Submittal procedures.
    - k. Review Procurement Schedule.
    - l. Preparation of Record Documents.
    - m. Use of the premises.
    - n. Responsibility for temporary facilities and controls.
    - o. Parking availability.
    - p. Office, work, and storage areas.
    - q. Equipment deliveries and priorities.
    - r. Safety/First aid.
    - s. Security.
    - t. Progress cleaning.
    - u. Working hours.
  3. Minutes: Contractor shall record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
  2. Preinstallation Conference Schedule:
    - a. Slab on grade.
    - b. Masonry/electrical/plumbing rough-in.
    - c. Mechanical/electrical/plumbing/fire protection coordination.
    - d. Roofing – standing seam and modified bitumen.
- D. Progress Meetings (OAC's): Conduct progress meetings every two weeks. Coordinate dates of meetings with preparation of payment requests.



1. Attendees: In addition to representatives of Owner and Architect, the contractor, and requested subcontractors shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    - b. Review present and future needs of each entity present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Status of submittals (log).
      - 4) Procurement Schedule.
      - 5) Deliveries.
      - 6) Off-site fabrication.
      - 7) Access.
      - 8) Site utilization.
      - 9) Temporary facilities and controls.
      - 10) Work hours.
      - 11) Hazards and risks.
      - 12) Progress cleaning.
      - 13) Quality and work standards.
      - 14) Change Orders status.
      - 15) Pending claims and disputes.
      - 16) RFI status.
      - 17) Review Monthly Pay Application with all related backup information.
      - 18) 30 day look ahead and behind.
      - 19) As-built review.
      - 20) Closeout Document Status.
      - 21) Review Owner furnished items.
  3. Reporting: Contractor shall record and distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
    - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with each months pay request.
- E. Fire Marshal Inspections: Schedule with Fire Marshal for inspections at 50%, 80%, 100% complete and as required by the AHJ.
- 1.7 REQUESTS FOR INFORMATION (RFIs)
- A. Procedure: Immediately on discovery of the need for information or interpretation of the Contract Documents, and if not possible to request information at Project meeting, prepare and submit an RFI in the form specified.

1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
  2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
  2. Date.
  3. Name of Contractor.
  4. Name of Architect.
  5. RFI number, number sequentially.
  6. Specification Section number and title and related paragraphs, as appropriate.
  7. Drawing number and detail references, as appropriate.
  8. Field dimensions and conditions, as appropriate.
  9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  10. Contractor's signature.
  11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
    - a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
- C. Architect's Action: Architect will review each RFI, determine action required, and return it. RFIs received after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
    - a. Request for approval of submittals
    - b. Requests for approval of substitutions.
    - c. Requests for coordination information already indicated in the Contract Documents.
    - d. Requests for adjustments in the Contract Time or the Contract Sum.
    - e. Requests for interpretation of Architect's actions on submittals.
    - f. Incomplete RFIs or RFIs with numerous errors.
  2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
  3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 1 Section "Contract Modification Procedures".
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- D. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log monthly. Include the following:
1. Project name.
  2. Name and address of Contractor.
  3. Name and address of Architect.

4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

END OF SECTION 01310 (see attached RFI Format)



RFI #

## Request for Information

<b>Project:</b>	Mill Creek Middle School Woodstock, Ga.	<b>Date Created:</b>	Month/Day/Year
		<b>Authored By:</b>	John Smith
		<b>Architects Project No.:</b>	17-005/0045CA

<b>Author Company</b>	<b>Answer Company</b>
<b>From:</b>	<b>To:</b> KRH Architects 855 Abutment Rd., Suite 4 Dalton, Ga. 30720

The Contractor shall notify KRH Architects, in writing, if any change in the Contract Sum or Contract Time is necessary based on this Request for Information. Any RFI received after 1:00 p.m. will be considered as received the following work day.

**Subject:****Question:****Suggestion:****Answer:****Date Returned:** Month/Day/Year

**SECTION 01320 - CONSTRUCTION PROGRESS DOCUMENTATION**

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 administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

- 1. Preliminary Construction Schedule.
- 2. Contractor's Construction Schedule.
- 3. Submittals Schedule.
- 4. Material location reports.
- 5. Field condition reports.
- 6. Construction photographs.
- 7. RFI Log.

- B. Related Sections include the following:

- 1. Division 1 Section "Summary of Multiple Contracts" for preparing a combined Contractor's Construction Schedule.
- 2. Division 1 Section "Payment Procedures" for submitting the Schedule of Values.
- 3. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
- 4. Division 1 Section "Submittal Procedures" for submitting schedules and reports.
- 5. Division 1 Section "Quality Requirements" for submitting a schedule of tests and inspections.
- 6. Division 1 Section "Closeout Procedures" for submitting photographic negatives as Project Record Documents at Project closeout.

- C. Preliminary Construction Schedule: Submit 2 (two) printed copies; one a single sheet of reproducible media, and one a print.

- D. Contractor's Construction Schedule: Submit 2 (two) printed copies of initial schedule, one a reproducible print and one a blue- or black-line print, large enough to show entire schedule for entire construction period.

1.3 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

- B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

- 1. Secure time commitments for performing critical elements of the Work from parties involved.

2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

## PART 2 - PRODUCTS

### 2.1 SUBMITTALS SCHEDULE

- A. Submittals Schedule: Comply with requirements in Division 1 Section "Submittal Procedures" for list of submittals and time requirements for scheduled performance of related construction activities.

### 2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."
- B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.
  1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
  1. Activity Duration: Define activities so no activity is longer than 45 (forty-five) days, unless specifically allowed by Architect.
  2. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
  3. Startup & Testing Time: Include days for startup and testing.
  4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of substantial Completion.
  5. Punch List and Final Completion: Include not more than 30 days for punch list and final completion (include closeout documents).
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

### 2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Construction Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within 10 (ten) days of date established for the Notice to Proceed. Base schedule on the Preliminary Construction Schedule and whatever updating and feedback was received since the start of Project. Dates shown in Section 00150 shall be reflected in schedule. Do not show early completion.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. The Schedule shall include only one critical path.
  1. For construction activities that require 3 months or longer to complete, indicate an estimated completion percentage in 10 (ten) percent increments within time bar.

## 2.4 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site”:
1. List of subcontractors at Project site.
  2. List of separate contractors at Project site.
  3. Approximate count of personnel at Project site.
  4. Equipment at Project site.
  5. Material deliveries.
  6. High and low temperatures and general weather conditions.
  7. Accidents.
  8. Meetings and significant decisions.
  9. Unusual events (refer to special reports).
  10. Stoppages, delays, shortages, and losses.
  11. Meter readings and similar recordings.
  12. Emergency procedures.
  13. Orders and requests of authorities having jurisdiction.
  14. Change Orders received and implemented.
  15. Construction Change Directives received and implemented.
  16. Services connected and disconnected.
  17. Equipment or system tests and startups.
  18. Partial Completions and occupancies.
  19. Substantial Completions authorized.
- B. Material Location Reports: At monthly intervals, prepare a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated away from Project site.
- C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Submit with a request for information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

## 2.4 SPECIAL REPORTS

- A. General: Submit special reports directly to the Owner/Architect within one day(s) of an occurrence. Submit copies of the report to all affected by the occurrence.
- B. Reporting Unusual Events: Prepare and submit a report if an unusual event whether related or not to the project to the Owner/Architect. List all parties involved, event that took place, response by Contractors personnel, results of the events, and any similar pertinent information.
- C. Quality Control reporting: Prepare, track and report all quality control issues as they arise. Include the date of occurrence and anticipated date for correction.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
  - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  - 3. As the Work progresses, indicate Actual Completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
  - 1. Post copies in Project meeting rooms and temporary field offices.
  - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01320



**SECTION 01322 - PHOTOGRAPHIC DOCUMENTATION**

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 administrative and procedural requirements for the following:
  - 1. Preconstruction photographs.
  - 2. Periodic construction photographs.
  - 3. Final Completion construction photographs.
- B. Related Sections include the following:
  - 1. Division 1 Section "Submittal Procedures" for submitting photographic documentation.
  - 2. Division 1 Section "Selective Demolition" for photographic documentation before selective demolition operations commence.
  - 3. Division 1 Section "Payment Procedures" for monthly photographic documentation.
  - 4. Division 2 Section "Building Demolition" for photographic documentation before building demolition operations commence.

1.3 SUBMITTALS

- A. Construction Photographs: Submit photographs on monthly intervals with the application for payment.
  - 1. Digital Images: Submit two copies of each complete set of digital image electronic files on a removable thumb drive. Identify electronic media with date photographs were taken. Submit images that have same aspect ratio as the sensor, uncropped.

1.4 QUALITY ASSURANCE

- A. Photographer Qualifications for Aerial Photographs: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

1.5 USAGE RIGHTS

- A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

## PART 2 - PRODUCTS

### 2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in uncompressed JPEG format, produced by a digital camera with minimum sensor size of 12.0 megapixels, and at an image resolution of not less than 1600 by 1200 pixels and 400 dpi.

## PART 3 - EXECUTION

### 3.1 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified commercial photographer to take aerial photographs.
- B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
  - 1. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
  - 2. Date and Time: Include date and time in filename for each image.
- C. Preconstruction Photographs: Before starting construction, take digital photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points.
  - 1. Flag construction limits before taking construction photographs.
  - 2. Take photographs to show existing conditions adjacent to property before starting the Work.
  - 3. Take photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
  - 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
  - 5. Take 4 aerial views of the Project Site.
- D. Periodic Construction Photographs: Take digital photographs daily, weekly, monthly or as otherwise necessary to show new work and progress of work. Coordinate with cutoff date associated with each application for payment. Provide a minimum of 60 photographs. Select vantage points to show status of construction and progress since last photographs were taken.
  - 1. Identification: Provide the following information with each digital image description in file metadata tag:
    - a. Project Name
    - b. Project Number
    - c. Photograph Number (order)
    - d. Date Taken
    - e. Location of Photograph
  - 2. Progress Photographs: Submit progress photos with monthly pay application. Photos to be submitted in a digital format.
  - 3. Aerial Photographs: On a monthly basis, provide a minimum of 4 aerial digital photographs of the entire Project Site. Select views to show status of construction and progress since last photographs were taken. Each photograph should be taken from the same position and altitude. Coordinate with cutoff date associated with each application for payment. Two sets of 8.5 x 11 full color prints and electronic files of aerial photographs shall be submitted monthly.

- E. Final Completion Construction Photographs: Take 10 digital photographs after date of Substantial Completion for submission as Project Record Documents. Architect will direct photographer for desired vantage points.
- F. Additional Photographs: Architect may issue requests for additional photographs, in addition to periodic photographs specified.
  - 1. Three days' notice will be given, where feasible.
  - 2. In emergency situations, take additional photographs within 24 hours of request.
  - 3. Circumstances that could require additional photographs include, but are not limited to, the following:
    - a. Special events planned at Project site.
    - b. Immediate follow-up when on-site events result in construction damage or losses.
    - c. Photographs to be taken at fabrication locations away from Project site.
    - d. Substantial Completion of a major phase or component of the Work.
    - e. Extra record photographs at time of final acceptance.
    - f. Owner's request for special publicity photographs.

END OF SECTION 01322

## **SECTION 01330 - SUBMITTAL PROCEDURES**

### **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 administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.
- B. Related Sections include the following:
  - 1. Division 1 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
  - 2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
  - 3. Division 1 Section "Closeout Procedures" for submitting closeout documents.
  - 4. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
  - 5. Division 2 – 16 Sections for requirements for submittals of operation of maintenance data, demonstration and training and special cleaning requirements for products of those sections.

#### **1.3 DEFINITIONS**

- A. Action Submittals: Written and graphic information that requires Architect's responsive action.
- B. Informational Submittals: Written information that does not require Architect's approval. Submittals may be rejected for not complying with requirements.

#### **1.4 SUBMITTAL PROCEDURES**

- A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.
- B. Electronic Submittals: All shop drawings and product data shall be submitted in electronic format to the project email address provided by the Architect. Material samples and mockups shall be shipped to the architect's office via USPS, UPS or FedEx.
- C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 2. Retain subparagraph and associated subparagraph below if one submittal has an impact on another submittal.

3. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
  - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
  - b. No color selections will be made until all submittals requiring color selection have been approved.
- D. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmitting, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making correction or modifications to submittals noted by the Architects office and additional time for handling and reviewing submittals required by those corrections.
  1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
  2. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule prior to submittal of first application for payment.
- E. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  1. Initial Review: Allow sufficient time for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  3. Resubmittal Review: Allow sufficient time for review of each resubmittal.
- F. Identification: Place a permanent label or title block on each submittal for identification.
  1. Indicate name of firm or entity that prepared each submittal on label or title block.
  2. Review thoroughly and Include the following information on label for processing and recording action taken:
    - a. Project name.
    - b. Date.
    - c. Name and address of Architect
    - d. Name and address of Contractor.
    - e. Name and address of subcontractor.
    - f. Name and address of supplier.
    - g. Name of manufacturer.
    - h. Number and title of appropriate Specification Section. Clearly indicate appropriate division number from 16 division format.
      - 1) Example – 08110 Steel Doors Section 2.3.
    - i. Drawing number and details, if necessary.
    - j. Location of product is to be installed, if necessary.
    - k. Remarks.
    - l. Other necessary identification.
- G. Options: Identify options requiring selection by the Architect.

- H. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals. Architects review / approval does not relieve the Contractor from any requirements of the contract documents.
  - I. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
  - J. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form.
- 1. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents and any comments stating noncompliance. Submittals will be returned to the contractor without action if the contractor fails to review the submittal and include his certification.
  - 2. Transmittal Form: Provide locations on form for the following information:
    - a. Project name.
    - b. Date.
    - c. Destination (To:).
    - d. Source (From:).
    - e. Names of subcontractor, manufacturer, and supplier.
    - f. Category and type of submittal.
    - g. Submittal purpose and description.
    - h. Specification Section number and title.
    - i. Drawing number and detail references, if necessary.
    - j. Submittal and transmittal distribution record.
    - k. Transmittal number.
    - l. Remarks.
    - m. Signature of transmitter.
  - 3. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.
- L. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
  - 1. Note date and content of previous submittal.
  - 2. Note date and content of revisions in label or title block and clearly indicate extent of revision.
  - 3. Resubmit submittals until they are marked "approved" or "approved as noted".
- M. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- N. Use for Construction: Use only final submittals with mark indicating action taken by Architect in connection with construction.
- O. Color Selection: No color selections will be made until all submittal requiring colors are submitted and approved.

## PART 2 - PRODUCTS

### 2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
1. Electronic Submittals: Submit electronic submittals to Architects office via email. All reviewed submittals will be returned via email. Verify size of document before emailing to Architects office. Anything over 10 MB will need to approved by Architect before submitting.
  2. Hard Copies Submittals: The architect's office may request hard copies of shop drawings and product data. No more than two copies will be requested per submittal.
    - a. Distribution of hard copies – If hard copies are requested, the Architect will retain both copies. Comments will be returned to the contractor by email.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's written recommendations.
    - b. Manufacturer's product specifications.
    - c. Manufacturer's installation instructions.
    - d. Standard color charts. Note any up-charge for premium or custom colors.
    - e. Manufacturer's catalog cuts.
    - f. Wiring diagrams showing factory-installed wiring.
    - g. Printed performance curves.
    - h. Operational range diagrams.
    - i. Standard product operating and maintenance manuals.
    - j. Compliance with recognized trade association standards.
    - k. Compliance with recognized testing agency standards.
    - l. Application of testing agency labels and seals.
    - m. Notation of coordination requirements.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate compliance with the contract documents. Include the following information, as applicable:
    - a. Dimensions.
    - b. Identification of products.
    - c. Fabrication and installation drawings.
    - d. Roughing-in and setting diagrams.
    - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    - f. Shopwork manufacturing instructions.
    - g. Templates and patterns.
    - h. Design calculations.
    - i. Compliance with specified standards.
    - j. Notation of coordination requirements.
    - k. Notation of dimensions established by field measurement.
    - l. Relationship to adjoining construction clearly indicated.
    - m. Seal and signature of professional engineer if required.
- D. Coordination Drawings: Comply with requirements in Division 1 Section "Project Management and Coordination."

- E. Samples: Prepare physical units of materials or products, including the following:
1. Comply with requirements in other sections for mockups.
  2. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
  3. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
  4. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's sample where so indicated. Attach label on unexposed side that includes the following:
  5. Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, provide the following:
    - a. Size limitations.
    - b. Compliance with recognized standards.
    - c. Availability.
    - d. Delivery time.
  6. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
    - a. If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit at least 3 (three) sets of paired units that show approximate limits of the variations.
  7. Number of Samples for Selection: Submit at a minimum of 3 (three) full set[s] of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return 1 (one) submittal with options selected.
  8. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
- F. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."
- G. Application for Payment: Comply with requirements in Division 1 Section "Payment Procedures."
- H. Schedule of Values: Comply with requirements in Division 1 Section "Payment Procedures."
- I. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
  2. Number and title of related Specification Section(s) covered by subcontract.

### PART 3 - EXECUTION

#### 3.1 CONTRACTOR'S REVIEW



- A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

### 3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows (see sample at the end of this section):
  - 1. Approved: Fabrication/installation may be undertaken. Approval does not authorize changes in the contract sum or contract time.
  - 2. Approved as Noted: Fabrication/installation may be undertaken subject to compliance with the noted comments. Approval does not authorize changes in the contract sum or contract time.
  - 3. Revise and Resubmit: Fabrication/installation may not be undertaken, Revise submittals in accordance with the noted comments. In resubmittal, limit corrections to the items marked and comments noted.
  - 4. Rejected: Fabrication/installation may not be undertaken. See noted reason(s) for rejection.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- E. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF SECTION 01330



855 Abutment Road  
Suite 4  
Dalton, Ga. 30721  
Phone: (706) 529.5895

OWNER  
ARCHITECT  
CONTRACTOR

## Submittal / Shop Drawing Review

<b>Project:</b>	Mill Creek Middle School Woodstock, Ga.	<b>Job No./Spec No.:</b>	17-005/				
		<b>Name of Submittal:</b>					
		<b>Order Number:</b>	xx				
		<b>Reviewed:</b>	NAME(KRH) x/x/2018				
<input type="checkbox"/>	<b>Approved</b>	<input type="checkbox"/>	<b>Approved As Noted</b>	<input type="checkbox"/>	<b>Revise and Resubmit</b>	<input type="checkbox"/>	<b>Rejected</b>

This submittal/shop drawing is reviewed for general conformance with the design concept and arrangement only. Submittals and shop drawings are not to be considered contract documents. Review is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. The contractor is responsible for all dimensions, clearances, layout, coordination with all trades, compliance with the contract documents and performing the work in a safe manner.

The following submittal has been reviewed as indicated thereon, subject to Contractor's compliance with all terms of his or her contract:

1.

**SECTION 01400 - QUALITY REQUIREMENTS**

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 administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Sections include the following:
  - 1. Divisions 2 through 16 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.
- D. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
  - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- J. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- K. Extended Warranties: Those warranties required by the Contract Documents with a warranty period greater than the one year general contractor's warranty.

#### 1.4 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

#### 1.5 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
  - 1. Specification Section number and title.
  - 2. Description of test and inspection.
  - 3. Identification of applicable standards.

4. Identification of test and inspection methods.
  5. Number of tests and inspections required.
  6. Time schedule or time span for tests and inspections.
  7. Entity responsible for performing tests and inspections.
  8. Requirements for obtaining samples.
  9. Unique characteristics of each quality-control service.
- C. Reports: Prepare and submit certified written reports that include the following:
1. Date of issue.
  2. Project title and number.
  3. Name, address, and telephone number of testing agency.
  4. Dates and locations of samples and tests or inspections.
  5. Names of individuals making tests and inspections.
  6. Description of the Work and test and inspection method.
  7. Identification of product and Specification Section.
  8. Complete test or inspection data.
  9. Test and inspection results and an interpretation of test results.
  10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  12. Name and signature of laboratory inspector.
  13. Recommendations on retesting and reinspecting.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.
- E. Contractor must submit an inventory of all attic stock to be turned over to Owner/Architect and it must be signed off/verified by the Architect.

#### 1.6 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work 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. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. 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 the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
  - 1. Requirement for specialists shall not supersede building codes and regulations governing the Work.
- G. Testing Agency Qualifications: An independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
  - 1. Testing Agencies must be approved in writing by the Owner/Architect before Contractor actually engages the Agency for services.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
  - 1. Contractor responsibilities include the following:
    - a. Provide test specimens representative of proposed products and construction.
    - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    - f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
  - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
  - 1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
  - 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
  - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
  - 4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
    - a. Allow seven days for initial review and each re-review of each mockup.
  - 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  - 6. Demolish and remove mockups when directed, unless otherwise indicated.

- K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 2 through 16.

## 1.7 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
  - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
  - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. The Owner will be responsible for the following quality-control testing services and inspections:
  - 1. Soil testing as required by Division 2 "Earthwork", excluding NPDES monitoring.
  - 2. Asphalt testing as required by Division 2 "Hot-Mix Asphalt Paving".
  - 3. Concrete testing as required by Division 3 "Cast-in-Place Concrete".
  - 4. Testing and inspection of unit masonry assemblies as required by Division 4 "Unit Masonry Assemblies".
  - 5. Testing and inspection of structural steel as required by Division 5 "Structural Steel".
- C. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
  - 3. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  - 4. Contractor shall be responsible for notifying all testing agencies including those provided by the Owner and coordinating all testing and inspections with the project schedule. Notify testing/inspection agencies at least 24 hours in advance of time when work that requires testing or inspection will be performed.
  - 5. Contractor shall insure that testing and inspections provided by the Owner are done within reasonable working hours and not on overtime hours. Costs associated with overtime hours required by the Owner's testing agency due to the faulty scheduling of the Contractor will be charged to the Contractor, and the Contract sum will be adjusted by Change Order.
  - 6. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  - 7. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  - 8. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  - 9. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

D. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, all cost for retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents are the responsibility of the Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for the Notice to Proceed.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

## 1.8 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by Chapter 17 of the Georgia Standard Building Code (International Building Code), 2006 Ed. With Georgia Amendments as follows:

1. Owner will provide Special Test and Inspections in accordance with the "Statement of Special Inspections" and "Schedule of Special Inspection Services," forms included at the end of Part 3 of the Specification Section.
  - a. All testing/inspections indicated as applicable to this Project shall be performed in accordance with and to the extent indicated on the "Schedule of Special Inspections".
  - b. The Owner will be responsible for identifying the Agent (Special Inspector(s)) provided for the Project.
  - c. These forms shall be maintained in a central location at the Project Site. These forms will need to be accessed on a regular basis by the Agent (Special Inspector(s)) for the Project.
  - d. When an individual Special Inspection task in the Schedule is completed for the last time on the Project and the Special Inspector has performed their final review, inspection, or test of that item for the Project, the Special Instructor shall initial and date the cell in the completed column on the forms adjacent to the task.



2. Special Inspectors shall keep records of all tests and inspections. The Special Inspector shall provide copies of Inspection Reports to the Contractor, Architect, Engineer of Record, and the Building Official.
  - a. Reports shall indicate that the Work inspected was done in conformance to the Contract Documents. Work not in conformance with the Contract Documents shall be brought to the attention of the Contractor for immediate correction. Retesting/inspection shall be performed to insure compliance with Contract Documents.
3. A "Final Report of Special Inspections" shall be provided for the Project at the completion of all Special Inspections and Testing required for this Project. See "Final Report of Special Inspections" Form at the end of Part 3 of this Specification Section.
  - a. Each Special Inspector corresponding to an Agent in the "Schedule of Special Inspections" shall be required to complete a copy of this form.
  - b. Copies of all "Final Report(s) of Special Inspections" shall be provided to the Contractor, Architect, Engineer of Record, and the Building Official.
  - c. Special Inspections will not be considered complete until all forms from all Agents (Special Inspector(s)) have been received.
4. The Contractor shall not proceed with additional work until work has been inspected and passed inspection. Installation of new work over uninspected or failed work will not be acceptable.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
  1. Date test or inspection was conducted.
  2. Description of the Work tested or inspected.
  3. Date test or inspection results were transmitted to Architect.
  4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

### 3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
  1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
- B. Protect construction exposed by or for quality-control service activities.

- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01400 (See attached Structural Statement of Special Inspections).

## **SECTION 01420 - REFERENCES**

### **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 DEFINITIONS**

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": The term "approved," when used in conjunction with Architect's action on Contractor's submittals, applications, and requests, is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by Architect, requested by Architect, and similar phrases.
- D. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on Drawings; or to other paragraphs or schedules in Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference.
- E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": The term "furnish" means to supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": The term "install" describes operations at Project site including unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.
- I. "Installer": An installer is Contractor or another entity engaged by Contractor, as an employee, subcontractor, or contractor of lower tier, to perform a particular construction operation, including installation, erection, application, and similar operations.
- J. The term "experienced," when used with the term "installer," means having successfully completed a minimum of 5 (five) previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
  - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

- K. "Project site" is the space available for performing construction activities, either exclusively or in conjunction with others performing other work as part of Project. The extent of Project site is shown on the Drawings and may or may not be identical with the description of the land on which Project is to be built.

### 1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Conflicting Requirements: Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
  - 1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to Architect for a decision before proceeding.
- C. Abbreviations and Names: Abbreviations and acronyms are frequently used in the Specifications and other Contract Documents to represent the name of a trade association, standards-developing organization, authorities having jurisdiction, or other entity in the context of referencing a standard or publication. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of these entities. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.," which are available in most libraries.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01420

**SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS**

**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 requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.
- B. Temporary utilities include, but are not limited to, the following:
  - 1. Sewers and drainage.
  - 2. Water service and distribution.
  - 3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
  - 4. Heating and cooling facilities.
  - 5. Ventilation.
  - 6. Electric power service.
  - 7. Lighting.
  - 8. Telephone service.
  - 9. Gas.
- C. Support facilities include, but are not limited to, the following:
  - 1. Temporary roads and paving.
  - 2. Dewatering facilities and drains.
  - 3. Project identification and temporary signs.
  - 4. Field offices.
  - 5. Storage and fabrication sheds.
  - 6. Lifts and hoists.
  - 7. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities include, but are not limited to, the following:
  - 1. Environmental protection.
  - 2. Stormwater control.
  - 3. Tree and plant protection.
  - 4. Pest control.
  - 5. Site enclosure fence.
  - 6. Barricades, warning signs, and lights.
  - 7. Covered walkways.
  - 8. Temporary enclosures.
  - 9. Temporary partitions.

**1.3 DEFINITIONS**

- A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

#### 1.4 USE CHARGES

- A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
  - 1. Owner's construction forces.
  - 2. Occupants of Project.
  - 3. Architect.
  - 4. Testing agencies.
  - 5. Personnel of authorities having jurisdiction.
- B. Electric Power Service: Pay electric power service use charges, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site.

#### 1.5 QUALITY ASSURANCE

- A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.
  - 1. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

#### 1.6 PROJECT CONDITIONS

- A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.
  - 1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.
- B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
  - 1. Keep temporary services and facilities clean and neat.
  - 2. Relocate temporary services and facilities as required by progress of the Work.
  - 3. No temporary living quarters are allowed on site.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.
- B. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.76-mm-) thick, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts.

- C. Portable Chain-Link Fencing: Minimum 2-inch (50-mm) 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide galvanized steel bases for supporting posts.
- D. Wood Enclosure Fence: Plywood, **6 feet (1.8 m)** high, framed with four 2-by-4-inch (50-by-100-mm) rails, with preservative-treated wood posts spaced not more than 8 feet (2.4 m) apart.
- E. Gypsum Board: Minimum 1/2 inch (12.7 mm) thick by 48 inches (1219 mm) wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36.
- F. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively.
- G. Paint: Comply with requirements in Division 9 Section "Painting."
- H. Tarpaulins: Fire-resistive labeled with flame-spread rating of 15 or less.
- I. Water: Potable.

## 2.2 EQUIPMENT

- A. General: Provide equipment suitable for use intended.
- B. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- C. Common-Use Field Offices: Of sufficient size to accommodate needs of construction personal office activities and to accommodate project meetings specified in other Division 1 Section. Keep office clean and orderly. Furnish and equip offices as follows:
  - 1. Furniture required for project-size documents including file cabinets, plan tables, plan racks, and bookcases.
  - 2. Conference room of sufficient size to accommodate meetings of at least 10 individuals. Provide electrical power services and 120v ac duplex receptacles, with at less 2 receptacle on each wall. Furnish room with conference table, chairs, and 4' long tack and markerboard.
  - 3. Provide drinking fountain and private toilet.
  - 4. Contractor shall have computer access to internet, Wi-Fi access for owner and architect along with the ability to send and receive construction photographs digitally on a daily basis.
  - 5. Contractor shall also have facilities to scan, fax, and print documents on site.
  - 6. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68° to 72°.
  - 7. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
- D. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
  - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
- E. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- F. Heating Equipment: Unless Owner authorizes use of permanent heating system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
  2. Heating Units: Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use for type of fuel being consumed.
- G. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.
- H. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

#### 3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
  2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
  3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.
- B. Water Service: Use of Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use. Utility use to be paid by contractor.
1. Provide rubber hoses as necessary to serve Project site.
  2. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.
- C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.



1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
  2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy.
- D. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed.
1. Maintain a minimum temperature of 50 deg F (10 deg C) in permanently enclosed portions of building for normal construction activities, and 65 deg F (18.3 deg C) for finishing activities and areas where finished Work has been installed.
- E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- F. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
1. Install electric power service underground, unless overhead service must be used.
  2. Install power distribution wiring overhead and rise vertically where least exposed to damage.
- G. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.
1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
  2. Provide warning signs at power outlets other than 110 to 120 V.
  3. Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage. Provide rigid steel conduits for wiring exposed on grades, floors, decks, or other traffic areas.
  4. Provide metal conduit enclosures or boxes for wiring devices.
- H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.
- I. Telephone Service: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities.

### 3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access as directed by architect.
  2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period and as required by authorities having jurisdiction. Locate temporary roads and paved areas in same location as permanent roads and paved areas. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
  - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
  - 2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Division 2 Section "Earthwork."
  - 3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
- C. Traffic Controls: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.
- D. Project Identification and Temporary Signs: Prepare Project identification and other signs in sizes indicated. Install signs as directed to inform public and persons seeking entrance to Project. Final information included on the sign is subject to change. A layout must be submitted to the Architect for approval prior to construction of the project identification signs. Do not permit installation of unauthorized signs.
  - 1. Engage an experienced sign painter to apply graphics for Project identification signs. Comply with details indicated.
  - 2. Prepare temporary signs to provide directional information to construction personnel and visitors.
  - 3. Construct signs of exterior-type Grade B-B high-density concrete form overlay plywood in sizes and thicknesses indicated. Support on posts or framing of preservative-treated wood or steel.
  - 4. Paint sign panel and applied graphics with exterior-grade alkyd gloss enamel over exterior primer.
  - 5. Project identification signs are shown at end of this section.
- E. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 1 Section "Execution Requirements" for progress cleaning requirements.
  - 1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.
- F. Janitorial Services: Provide janitorial services on a daily basis for temporary offices, first-aid stations, toilets, wash facilities, lunchrooms, and similar areas.
- G. Common-Use Field Office: Provide an insulated, weathertight, air-conditioned field office for use as a common facility by all personnel engaged in construction activities; of sufficient size to accommodate required office personnel and meetings. Keep office clean and orderly.
- H. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility services. Sheds may be open shelters or fully enclosed spaces within building or elsewhere on-site.

### 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air,

waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.

- B. Stormwater Control: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.
- C. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion.
- D. Site Enclosure Fence: Before construction operations begin, install portable chain-link enclosure fence with lockable entrance gates. Locate where indicated, or enclose entire Project site or portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.
- E. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- F. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
  - 1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
  - 2. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.
  - 3. Where temporary wood or plywood enclosure exceeds 100 sq. ft. (9.2 sq. m) in area, use fire-retardant-treated material for framing and main sheathing.
- H. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.
  - 1. Construct dustproof partitions of not less than nominal 4-inch (100-mm) studs, 5/8-inch (16-mm) gypsum wallboard with joints taped on occupied side, and 1/2-inch (13-mm) fire-retardant plywood on construction side.
  - 2. Insulate partitions to provide noise protection to occupied areas.
  - 3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
  - 4. Protect air-handling equipment.
  - 5. Weatherstrip openings.
- I. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
  - 1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.

- a. Field Offices: Class A stored-pressure water-type extinguishers.
  - b. Other Locations: Class ABC dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for exposures.
  - c. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.
2. Store combustible materials in containers in fire-safe locations.
  3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
  4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
  5. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
  6. Develop and supervise an overall fire-prevention and first-aid fire-protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

### 3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.
  1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
  2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Temporary Facility Changeover: Except for using permanent fire protection as soon as available, do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
  1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification signs.
  2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 1 Section "Closeout Procedures."

END OF SECTION 01500

**SECTION 01700 - EXECUTION REQUIREMENTS**

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 general procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. General installation of products.
  - 4. Coordination of Owner-installed products.
  - 5. Progress cleaning.
  - 6. Starting and adjusting.
  - 7. Protection of installed construction.
  - 8. Correction of the Work.
- B. Related Sections include the following:
  - 1. Division 1 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
  - 2. Division 1 Section "Submittal Procedures" for submitting surveys.
  - 3. Division 1 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
  - 4. Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
  - 1. Before construction, verify the location and points of connection of utility services.

- B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
  - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
  - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - 1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  - 2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  - 3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  - 4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Architect and Owner not less than 5 (five) days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Architect's or Owner's written permission.
- C. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

### 3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a land surveyor/professional engineer to lay out the Work using accepted surveying practices.
  - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  - 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  - 3. Inform installers of lines and levels to which they must comply.
  - 4. Check the location, level and plumb, of every major element as the Work progresses.
  - 5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
  - 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

### 3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
  - 1. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

### 3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  - 2. Allow for building movement, including thermal expansion and contraction.
- G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.6 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction forces.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.
  - 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
  - 2. Preinstallation Conferences: Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

### 3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
  - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  - 2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
  - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  - 1. Remove liquid spills promptly.
  - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.



- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
  - 1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
- H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

### 3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01700

**SECTION 01731 - CUTTING AND PATCHING**

**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 procedural requirements for cutting and patching.
- B. Related Sections include the following:
  - 1. Divisions 2 through 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
    - a. Requirements in this Section apply to mechanical and electrical installations. Refer to Divisions 15 and 16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

**1.3 DEFINITIONS**

- A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

**1.4 SUBMITTALS**

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
  - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
  - 2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
  - 3. Products: List products to be used and firms or entities that will perform the Work.
  - 4. Dates: Indicate when cutting and patching will be performed.
  - 5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
  - 6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.

7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

## 1.5 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
  1. Primary operational systems and equipment.
  2. Air or smoke barriers.
  3. Fire-protection systems.
  4. Control systems.
  5. Communication systems.
  6. Electrical wiring systems.
  7. Operating systems of special construction in Division 13 Sections.
- C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
  1. Water, moisture, or vapor barriers.
  2. Membranes and flashings.
  3. Exterior curtain-wall construction.
  4. Equipment supports.
  5. Piping, ductwork, vessels, and equipment.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

## 1.6 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections of these Specifications.
- B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
  1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to interruption of services to occupied areas.
- E. Maintain all existing exits and corridors in operation throughout construction.

#### 3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  3. Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting. Patch back surrounding surfaces.
  6. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
  2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
  4. Ceilings: Patch, repair, or rehang existing ceilings if scheduled to remain as necessary to provide an even-plane surface of uniform appearance.
  5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

END OF SECTION 01731

## **SECTION 01770 - CLOSEOUT PROCEDURES**

### **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 administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Inspection procedures.
  - 2. Project Record Documents.
  - 3. Operation and maintenance manuals.
  - 4. Warranties.
  - 5. Instruction of Owner's personnel.
  - 6. Final cleaning.
- B. Related Sections include the following:
  - 1. Division 1 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
  - 2. Division 1 Section "Construction Progress Documentation" for submitting Final Completion construction photographs and negatives.
  - 3. Division 1 Section "Execution Requirements" for progress cleaning of Project site.
  - 4. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
  - 5. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
  - 6. Divisions 2 through 16 Sections for specific closeout and special cleaning requirements for products of those Sections.
- C. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following.
  - 1. Prepare a list of items to be completed and corrected (General Contractors Punch List), the value of items on the list, and reasons why the Work is not complete.
  - 2. Advise Owner of pending insurance changeover requirements.
  - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases. Final certificate of occupancy from fire marshal having jurisdiction and other authorities having jurisdiction must be submitted to Architect.
  - 5. Prepare Project Record Documents (As Builts), operation and maintenance manuals, Closeouts Documents, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.

6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Complete startup testing of systems.
8. Submit test/adjust/balance records.
9. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
10. Request Owner of changeover in heat and other utilities.
11. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
12. Complete final cleaning requirements, including touchup painting.
13. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
14. Only after Owner's approval, make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
15. All power, lighting and electrical systems including TV Systems shall be complete.
16. All emergency systems including fire alarm, sprinkler, and emergency power back-up systems shall be complete.
17. All egress systems and hardware shall be complete.
18. Visual completion: The interior and the exterior including sitework shall have an acceptable aesthetic appearance.
19. There shall be no rejected work items.
20. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
21. Perform demonstration of equipment as stated in the Food Services Equipment, 11400.
22. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
23. The General Contractor shall have tagged, identified, and organized the following keys, tools, and wrenches and shall have turned them over to the Owner:
  - a. Doors
  - b. Electrical panels
  - c. Toilet accessories
  - d. Hose bibbs – 1 key per hose bibb
  - e. Light switches – 1 key per switch
  - f. Wood cabinets
  - g. Door closers
  - h. Door exit devices
  - i. Fire alarm cabinets
  - j. Fire extinguisher cabinets
  - k. HVAC control panels
  - l. Kitchen equipment
  - m. Any and all other keys associated with Project

- D. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

### 1.3 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."



2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Submit pest-control final inspection report and warranty.
  5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
  6. Submit all required warranties.
  7. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when the Owner took possession of and assumed responsibility for corresponding elements of the Work.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will certify an approved final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected. Contractor shall reimburse the Owner for final re-inspections for time incurred in re-inspections at the rate of \$135.00 per hour for each inspector on team.

#### 1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit an electronic copy of the punch list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
  2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
  3. List whom is responsible for each item.
  4. Date when item will be complete.
  5. Note any incomplete item and state why.

#### 1.5 WARRANTIES

- A. Submittal Time: Upon issuance of Substantial Completion and prior to requesting final inspection, submit all contract-required warranties. All warranties required by the Contract Documents shall commence on the date of the Final Completion of the Work unless otherwise noted. Items that are incomplete at Substantial Completion or that are in non conformance with the project requirements shall be listed by the Architect to be re-evaluated at Final Completion. The warranties for any listed item will begin at Final completion not at Substantial.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
1. Bind warranties and bond in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8- 1/2 by 11-inch (215-by-280-mm) paper.

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES", Project name, and name of Contractor.
  4. Provide three (3) copies of the warranty binder & an electronic copy.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

1.6 CLOSEOUT DOCUMENTS – PROVIDE (1) THREE HARD COPIE & AN ELECTRONIC COPY

- A. Submit closeout documents in an organized heavy-duty, 3-ring, loose-leaf binder, in thickness necessary to accommodate contents. Identify on the cover of the binder the following:

Title:

Owner's Name:

Project Name:

Project Address:

Architect's Name:

Engineer's Name:

General Contractor's Name:

- B. Include as the first sheet of the binder a Table of Contents. The remainder of the binder shall be divided into sections. Provide plastic-covered tabs, clearly labeled, to separate each area of the Closeout Documents. The sections of the binder shall be as follows:

1. Section 1 – Contact List

- a. The contact list shall include the company name and or individual of each subcontractor and or individual that performed work on the project. It should also include a contact name, phone number (office & cellular), fax number, e-mail address and job performed.

2. Section 2 - Warranties

- a. See Section 01740 – Warranties for warranty requirements. All warranties dates shall start on date of final completion.

3. Section 3 – Release of Lien and Affidavit

- a. Provide a properly executed Final Waiver of Lien from each subcontractor, sub-subcontractor and or individual performing work on the Project.

4. Section 4 – Operation and Maintenance Manuals

- a. The Operation and Maintenance Manuals shall be submitted in separate binders. Include in this binder a transmittal letter showing that the Operation and Maintenance Manuals have been delivered to the architect and who received and signed for the delivery and the date delivered. The Operation and Maintenance Manuals delivered to the Architect shall be as follows:

1. Assemble a complete set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:

aa. Operation Data:

1. Emergency instructions and procedures.
2. System, subsystem, and equipment descriptions, including operating standards.

3. Operating procedures, including startup, shutdown, seasonal, and weekend operations.
      4. Description of controls and sequence of operations.
      5. Piping diagrams.
    - bb. Maintenance Data:
      1. Manufacturer's information, including list of spare parts.
      2. Name, address, and telephone number of installer or supplier.
      3. Maintenance procedures.
      4. Maintenance and service schedules for preventive and routine maintenance.
      5. Maintenance record forms.
      6. Sources of spare parts and maintenance materials.
      7. Copies of maintenance service agreements.
      8. Copies of warranties and bonds.
  2. Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.
5. Section 5 – Project Record Documents (As-Built)
- a. Contractor shall provide Owner/Architect with CAD drawing files of all Project Record Document (As-builts).
  - b. The Project Record Documents shall be submitted in a separate package (provide one hard copy with an electronic copy). Include in this binder a transmittal letter showing that the Project Record Documents have been delivered to the architect and who received and signed for the delivery and the date delivered. The "As-Built" drawings and specifications shall comply with the following:
    1. General: Do not use Project Record Documents for construction purposes. Protect Project Record from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.
    2. Record Drawings: Maintain and submit one set of black-line white prints of Contract Drawings and Shop Drawings.
      - a. Mark Record Prints (As-Builts) to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
      - b. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
      - c. Accurately record information in an understandable drawing technique.
      - d. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
      - e. Content: Types of items requiring marking include, but are not limited to, the following:
        - i. Post all Addenda on Drawings
        - ii. Dimensional changes to Drawings
        - iii. Revisions to details shown on Drawings
        - iv. Depths of foundations below first floor
        - v. Locations and depths of underground utilities
        - vi. Revisions to routing of piping and conduits
        - vii. Revisions to electrical circuitry
        - viii. Actual equipment locations
        - ix. Duct size and routing
        - x. Locations of concealed internal utilities
        - xi. Changes made by Change Order or Field Order

- xii. Changes made following Architect's written orders
  - xiii. Details not on the original Contract Drawings
  - xiv. Field record for variable and concealed conditions
  - xv. Record information on the Work is shown only schematically
  - f. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked show cross-reference on Contract Drawings.
  - g. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
  - h. Mark important additional information that was either shown schematically or omitted from original Drawings.
  - i. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
  - j. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.
6. Section 6 – Project Record Documents (Specifications)
- a. Record Specifications: Submit one hard copy and an electronic copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
    - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
    - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
    - 3. Note related Change Orders, where applicable.
7. Section 7 – Permits and Reports
- a. Provide a copy of all permits and inspection reports that were required during the construction of the project. Including, but not limited to Building Permit, Building Inspector inspection reports, Fire Marshall Inspection Reports, Utility Inspections, Equipment Start-Up Reports, etc.
8. Section 8 – Termite Control
- a. Provide a letter of certification for the soil treated product. Provide all required warranty items under Section 2 of this binder.
9. Section 9 – Spare Parts and Maintenance Stock
- a. Provide a signed transmittal letter indicating that all spare parts and maintenance stock of materials has been delivered as required by various Sections of the Specifications. The transmittal letter shall indicate what items have been delivered, the quantity, where delivered, who received and the date received.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 DEMONSTRATION AND TRAINING

- A. Instruction: Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
  - 1. Provide instructors experienced in operation and maintenance procedures.
  - 2. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
  - 3. Schedule training with Owner with at least 7 (seven) days' advance notice.
  - 4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.
- B. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections. For each training module, develop a learning objective and teaching outline. Include instruction for the following:
  - 1. System design and operational philosophy.
  - 2. Review of documentation.
  - 3. Operations.
  - 4. Adjustments.
  - 5. Troubleshooting.
  - 6. Maintenance.
  - 7. Repair.

3.2 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturers written instructions.
  - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. Remove snow and ice to provide safe access to building.
    - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - h. Sweep concrete floors broom clean in unoccupied spaces.

- i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
  - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
  - k. Remove labels that are not permanent.
  - l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
  - m. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - n. Replace parts subject to unusual operating conditions.
  - o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  - p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - q. Clean ducts, blowers, and coils if units were operated without filters during construction.
  - r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
  - s. Leave Project clean and ready for occupancy.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests guaranteed for a period of one year following final completion. Prepare a report.
- D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01770

## **SECTION 02000 - EROSION CONTROL**

### PART 1 - GENERAL

#### 1.01 SUMMARY

A. THIS SECTION INCLUDES:

1. Erosion and sedimentation control devices and measures.
2. State of Georgia NPDES permit monitoring and reporting requirements.

#### 1.02 RELATED DOCUMENTS/SECTIONS

- A. Contract documents and drawings, geotechnical soils engineering report. Refer to appropriate related sections as applicable.

#### 1.03 REFERENCED STANDARDS

- A. The current Manual for Erosion and Sediment Control in Georgia (**MESCG**).
- B. State of Georgia current NPDES permit requirements for proposed construction activity.

When standards or specifications are indicated herein by reference, the referenced portion shall apply to the most recent edition of the publication and shall have the same force and effect as if they were included herein in their entirety.

#### 1.04 DESCRIPTION OF WORK

- A. This work shall consist of erosion and sedimentation control measures and devices, installation and maintenance as shown on the drawings or directed by the authority having jurisdiction for the life of the Contract.
- B. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. All materials and construction shall conform to the **Manual for Erosion and Sediment Control in Georgia** (hereinafter referred to as **MESCG**), current edition.
- B. Temporary and permanent grassing, landscaping, trees or other vegetation shall conform to the Contract documents, plans, and drawings and the MESCG. Contractor shall coordinate with Architect/Engineer on all phases of landscaping. Refer to MESCG for detailed planting specifications, dates, and appropriate materials.
- C. All erosion control Matting and Blankets materials shall be temporary matting and blankets and shall be biodegradable and photodegradable. Do not install permanent type matting or blankets which are non-biodegradable or non-photodegradable unless specifically shown on plans.

### PART 3 – EXECUTION

#### 3.01 EXECUTION

- A. **All erosion and sedimentation control measures shall be installed prior to any land disturbing activity in accordance with the MESCG.**
- B. **PERMANENT GRASSING REQUIREMENTS:**

**THE CONTRACTOR SHALL ESTABLISH PERMANENT GRASSING PER PLANS AND SPECIFICATIONS ON ALL DISTURBED AREAS WHETHER SHOWN ON THE PLANS OR NOT. GRASS TYPE AND MATERIAL SUBJECT TO OWNER/ARCHITECT APPROVAL.**

- C. **NPDES STORM WATER DISCHARGE MONITORING REQUIREMENTS:**

**CONTRACTOR SHALL FULLY COMPLY WITH THE CURRENT STATE OF GEORGIA NPDES PERMIT REQUIREMENTS FOR NOTIFICATION, DOCUMENTATION, MONITORING, MAINTENANCE AND REPORTING REQUIREMENTS. CONTRACTOR SHALL SIGN AND CERTIFY SOLELY AS OPERATOR THE NOTICE OF INTENT (NOI), AND ANY OTHER CERTIFICATIONS, FORMS, FEES, OR APPLICATIONS REQUIRED FOR FULL COMPLIANCE. CONTRACTOR SHALL COPY TO OWNER IMMEDIATELY ALL NOTIFICATION, REPORTING, AND DOCUMENTATION REQUIRED OR RELATED TO NPDES PERMIT REQUIREMENTS.**



- D. Construction exit shall be maintained in a condition which will prevent tracking or flow of mud onto public streets.
- E. All erosion control grassing and landscaping shall comply at a minimum with the "Vegetative Considerations" in the MSECG.
- F. All measures shown on the construction plans shall be installed. Additional measures may be required as necessary by the local authority having jurisdiction or the project Engineer.
- G. Erosion control devices shall be periodically inspected and repaired, cleaned out, or restored as needed in order to function properly until permanent erosion control measures are established.
- H. All disturbed areas shall be permanently grassed and landscaped as soon as possible after grade is established.
- J. All naturally occurring water, streams, creeks, lakes, springs, etc. present on site shall have a minimum 25 foot undisturbed natural buffer measured from the top of bank. Tributaries to the Chattahoochee River, designated trout streams, or other such water sources, shall have a buffer of 35 feet or more.  
Contractor shall confirm minimum buffer width as required by the State of Georgia. Local authority may require buffer width(s) greater than State of Georgia. Contractor shall determine minimum buffer width and maintain said buffer throughout construction. The Contractor shall not encroach this buffer whether shown on the plans or not unless a buffer waiver permit has been acquired.
- K. Install Rock Dams (Rd) at any and all points of concentrated flow which impacts any and all Silt Fence (Sd1). Concentrated flow may occur naturally or as a result of construction or temporary or final grading. The Contractor is responsible for field verification of any concentrated flow points which impact Silt Fence (Sd1) and installation of Rock Dams (Rd) at all such locations. Remove Silt Fence for required width of Rock Dam(s). Install Rock Dams so that all concentrated flow is filtered through the Rock Dams and no flow is allowed to bypass around the sides of the Rock Dams or between the Rock Dams and Silt Fence.

END OF SECTION 02000



## **SECTION 02100 – AS BUILT SURVEY**

### PART 1 - GENERAL

#### 1.01 SUMMARY

A. THIS SECTION INCLUDES:

1. As built survey requirements.

#### 1.02 RELATED DOCUMENTS/SECTIONS

- A. Contract documents and drawings. Refer to appropriate related sections as applicable.

#### 1.03 REFERENCED STANDARDS

- A. State of Georgia surveying and plat laws and regulations.

#### 1.04 DESCRIPTION OF WORK

- A. This work shall consist of as built survey and drawings for the entire completed site and building improvements.
- B. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. Reserved

### PART 3 – EXECUTION

#### 3.01 EXECUTION

- A. Contractor shall provide to Owner and Architect/Engineer a complete as built survey to include horizontal and vertical information for the entire site and building improvements. The drawings and plats shall include,

but not be limited to:

Boundary survey, location, site location map, elevation, height and square footage of all buildings, parking areas, drives, utilities, walls, storm sewer, all storm, sanitary, or other pipe sizes, depths, inverts, storm water pond(s) or facilities with complete topographic information on dams, volumes, complete as built information for all pond outlet control structures with drawings for structures, weirs, orifices, notches, spillways, and all other improvements, fences, out buildings, canopies, sidewalks, ramps, roadway improvements, decel lanes, left turn lanes, dumpster pads, transformers, loading areas, parking spaces, islands, play areas, signs, water meters and vaults, and all other site or building improvements.

- B. As Built survey(s) and drawings shall comply with Local Authority Having Jurisdiction (LAHJ) standards and specifications. The Contractor is responsible for verification of and compliance with LAHJ standards and specifications PRIOR TO CONSTRUCTION. As built survey(s) and drawings shall comply with horizontal and vertical datum as specified by the LAHJ. In the absence of LAHJ requirements for vertical and horizontal datum, contact Owner/Architect/Engineer for direction regarding horizontal and vertical datum requirements for survey prior to construction.
- C. As Built Survey(s) and drawings shall be completed and submitted to Owner/Architect/Engineer in a timely manner to allow for review and approval. Contractor shall not receive final release until As Built Survey(s) and drawings are approved by Owner/Architect/Engineer and accepted and approved by the LAHJ.

END OF SECTION 02100

## **SECTION 02110 - SITE CLEARING & DEMOLITION**

### PART 1 - GENERAL

#### 1.01 SUMMARY

##### A. THIS SECTION INCLUDES:

1. Protection of existing trees to remain.
2. Removal of surface debris, trees, and other vegetation not designated to remain.
3. Topsoil excavation.
4. Clearing and grubbing.
5. Demolition.
6. Disposal of waste materials.

#### 1.02 RELATED DOCUMENTS / SECTIONS

- ##### A.
- Contract documents and drawings, geotechnical soils engineering report. Refer to appropriate related sections as applicable.

#### 1.03 REGULATORY REQUIREMENTS

- ##### A.
- Verify and conform to all Federal, State, County or local requirements concerning site clearing and related activities.
- ##### B.
- Coordinate and obtain approval for all clearing and demolition work with all appropriate utility companies prior to start of construction.
- ##### C.
- WARNING:**  
**NO PERSON(S) SHALL ENTER MANHOLES, CONFINED SPACES, OR OTHER UNDERGROUND STRUCTURES, TRENCHES, OR EXCAVATIONS WITHOUT PROTECTIVE BREATHING APPARATUS AND AT LEAST ONE OTHER PERSON PRESENT FOR SAFETY AND ABOVE GROUND MONITORING AT ALL TIMES. CONTRACTOR SHALL PROVIDE AND ENSURE USE OF SAFETY KITS, HELMETS, GLOVES, EMERGENCY OXYGEN RESUSCITATOR KITS, AND AIR QUALITY AND GAS DETECTORS FOR VOLATILE, TOXIC, OR EXPLOSIVE GASES OR SUBSTANCES. VERIFY SAFE OXYGEN CONTENT PRIOR TO ENTERING MANHOLES, CONFINED SPACES, OR OTHER UNDERGROUND STRUCTURES.**

#### 1.04 DESCRIPTION

- A. This work shall consist of clearing, grubbing, removal and disposal of all vegetation and debris (not designated to remain) within the limits of construction, and demolition of all existing items, structures, improvements, or other elements designated to be removed or required to be removed for the completion of the work.
- B. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, and specifications, the more stringent requirement shall apply as determined by the Engineer.

## PART 2 - EXECUTION

### 2.01 PREPARATION / PROTECTION

- A. Traffic: Do not close or obstruct streets, walks, or other occupied or used facilities without written permission from Owners or authorities having jurisdiction.
- B. Existing improvements: Provide measures necessary to protect adjoining properties and Owner's property from damage during site clearing. Damaged improvements shall be restored by the Contractor to their original condition, as acceptable to property owners.
- C. The contractor shall coordinate with the all utility authorities the location, size and material, origin, identification, and verification of all existing utilities onsite. Utilities which are to remain shall be protected from damage during construction.
- D. Existing trees, shrubs, or other vegetation designated to remain shall be protected and clearly delineated or marked for visual identification. The contractor shall coordinate with the Architect/Engineer on protection measures to ensure that any necessary cutting, grading, or other work in close proximity to trees or other vegetation is done in a manner which will minimize potential damage.
- E. The contractor shall protect bench marks and existing structures from damage or displacement.

### 2.03 CLEARING

- A. Definition: Clearing consists of the removal from the site and proper disposal of all exposed objectionable matter such as trees, brush, logs, grass, weeds, roots, decayed vegetable matter, poles, stubs, rubbish,

refuse dumps, sawdust piles, loose boulders of one cubic yard or less outside of construction limits, and other debris resting on or protruding through the ground surface, or appearing on the site.

- B. Clearing also includes the removal and proper disposal of all obstructions not to be retained.
- C. Clearing may be done by any legal method the contractor elects to use provided no damage is done to the property, trees or vegetation to be retained, in or outside of the site.
- D. Remove any remaining pavement, curbing, or other site improvement or obstruction necessary to facilitate the proposed construction as shown on the contract documents and drawings.

#### 2.04 GRUBBING

- A. Definition: Grubbing consists of the removal from the site and proper disposal of objectionable matter defined above under CLEARING, which is imbedded in the underlying soil.
- B. Use only hand methods for grubbing required within five feet of drip lines of trees designated to remain and tree protection limits.
- C. Objectionable Roots: Objectionable roots are defined as (1) matted trees and brush roots regardless of the size of the roots; (2) individual roots more than 3/4 inch diameter; (3) individual roots more than 36 inches long regardless of the size; (4) large quantities of lesser size roots present in the top 12 inches of the finished subgrade.
- D. When these items are removed as clearing and grubbing, they shall be removed to the following depths:
  - (1) Under pavements: Remove to a depth of 3.0 feet minimum below finish subgrade.
  - (2) Beneath other structures: Remove to a depth of 3.0 feet minimum below finish subgrade.
  - (3) Elsewhere on the site: Remove to a depth of 3.0 feet minimum below the finished surface for slopes and shoulders, 1.0 feet below natural ground outside construction limits.

#### 2.05 TOPSOIL EXCAVATION

- A. Definition: Topsoil is defined as friable clay loam surface soil found in

varying depths onsite. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 1/2 inch in diameter, without weeds, roots, or other objectionable material as defined in section 2.03 (A.)

- B. Topsoil excavation: Excavate topsoil to depths encountered in a manner which will minimize intermingling with underlying subsoil or objectionable material. Stockpile topsoil in storage piles to provide free drainage of surface water. Cover storage piles, if necessary, to prevent wind or water erosion. Dispose of unsuitable or excess topsoil as specified for disposal of waste materials. Do not excavate wet topsoil.

## 2.06 DEMOLITION

- A. **THE CONTRACTOR IS FULLY AND COMPLETELY RESPONSIBLE FOR LOCATION, VERIFICATION, PROTECTION, STORAGE, MAINTENANCE, DEMOLITION, REMOVAL, RELOCATION OR ALTERATION OF ALL EXISTING SITE UTILITIES, SITE IMPROVEMENTS, STRUCTURES, OR CONSTRUCTION ELEMENTS AS REQUIRED TO COMPLETE THE WORK, WHETHER SHOWN ON THE PLANS OR NOT. THE CONTRACTOR SHALL VISIT THE SITE AND BECOME THOROUGHLY FAMILIAR WITH ALL EXISTING IMPROVEMENTS, UTILITIES, AND SITE CONDITIONS PRIOR TO BIDDING AND CONSTRUCTION.**
- B. Items designated or required to be removed shall be completely removed and disposed of offsite in a legal manner. All items to be removed shall be removed in their entirety including all associated elements, layers, materials, sections, foundations, equipment, or levels; removal shall continue to the natural soil subgrade level at which all items designated for removal have been removed. No digging or removal past the natural soil subgrade level at which all items designated for removal have been removed is permitted.
- C. Protect all items not designated for removal from damage, encroachment, or disturbance. All damaged items shall be restored completely by Contractor at no expense to Owner.

## 2.07 DISPOSAL OF WASTE MATERIALS

- A. Contractor shall dispose of all waste material offsite in a legal manner.
- B. Burning: Burning will be permitted only by legally authorized permit, subject to permit requirements.



C. Burying onsite is prohibited.

END OF SECTION 02110



## **SECTION 02200 – EARTHWORK**

### PART 1 - GENERAL

#### 1.01 SUMMARY

##### A. THIS SECTION INCLUDES:

1. Project conditions
2. Quality assurance
3. Rough Grading
4. Proof rolling
5. Submittals
6. Excavating
7. Backfill and fill
8. Trenching
9. Rock removal
10. Disposal

#### 1.02 RELATED DOCUMENTS / SECTIONS

- ##### A.
- Contract documents and drawings, geotechnical soils report (if available). Refer to appropriate related sections as necessary.

#### 1.03 REFERENCES

- A. AASHTO - M147 - Materials for aggregate and soil aggregate.
- B. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb. (4.45 kg) Rammer and an 18-in. (457 mm) drop.
- C. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Course Aggregates.
- D. ANSI/ASTM D698 - Standard Proctor Test - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using a 5.5 lb. (2.49 kg) Rammer and 12 inch (304.8 mm) drop.
- E. ANSI/ASTM D1557 - Modified Proctor Test - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.45 kg) Rammer and 18 inch (457 mm) Drop.
- F. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- G. ASTM D2487 - Classification of Soils for Engineering Purposes.
- H. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- I. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

- J. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- K. ANSI/ASTM D1556 - Test Method for Density of Soil using the Sand-Cone Method.
- L. GE - Geotechnical Engineer, Engineering Report, Recommendations.
- M. NFPA - Code for explosive materials

When standards or specifications are indicated herein by reference, the referenced portion shall apply to the most recent edition of the publication and shall have the same force and effect as if they were included herein in their entirety.

#### 1.04 REGULATORY REQUIREMENTS

- A. Verify and comply with all Federal, OSHA, State, County, City or local requirements concerning earthwork, excavation, and related activities.
- B. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.
- C. **WARNING:**  
**NO PERSON(S) SHALL ENTER MANHOLES, CONFINED SPACES, OR OTHER UNDERGROUND STRUCTURES, SPACES, TRENCHES, OR EXCAVATIONS WITHOUT PROTECTIVE BREATHING APPARATUS AND AT LEAST ONE OTHER PERSON PRESENT FOR SAFETY AND ABOVE GROUND MONITORING AT ALL TIMES. CONTRACTOR SHALL PROVIDE AND ENSURE USE OF SAFETY KITS, HELMETS, GLOVES, EMERGENCY OXYGEN RESUSCITATOR KITS, AND AIR QUALITY AND GAS DETECTORS FOR VOLATILE, TOXIC, OR EXPLOSIVE GASES OR SUBSTANCES. VERIFY SAFE OXYGEN CONTENT PRIOR TO ENTERING MANHOLES, CONFINED SPACES, OR OTHER UNDERGROUND STRUCTURES.**

#### 1.05 PROJECT CONDITIONS

- A. Site information: All earthwork, cutting, filling, compaction, and related operations shall conform to the requirements and recommendations of the geotechnical Soils Engineer. In the absence of a qualified geotechnical Soils Engineer, the Contractor shall be fully responsible for the integrity, suitability, quantity, compaction, selection, and quality of the soils used in the completion of the Work.
- B. Protection of persons and property:

1. Barricade all open excavations occurring as part of this work and post with warning lights.
2. Operate warning lights or devices for all excavations, restricted or dangerous areas, or other areas as required for safety of all person(s) onsite or in the work area, as required BY OSHA, Federal, State, and local laws, or recommended by authorities having jurisdiction. All warning lights or devices shall be illuminated for night or low visibility conditions.
3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, or other hazards created by earthwork operations.
4. The Contractor, and all sub-contractors, shall be responsible for all safety measures, procedures, or devices as required by OSHA, Federal, State, or local authorities. No person shall enter a manhole or other underground structure without protective breathing apparatus, and at least one other person present for safety. All earthwork, trenching, and grading operations shall conform to minimum OSHA requirements for safety, shoring, bracing, and protective measures.

#### 1.06 QUALITY ASSURANCE

- A. Testing and Inspection service: Contractor shall employ and pay for a qualified independent Geotechnical Engineer (GE) and geotechnical testing laboratory to perform soil testing and inspection services during earthwork operations and as specified by the Architect/Engineer. All testing, earthwork, excavation, cut and fill operations and associated work shall comply with GE recommendations and standards at a minimum. GE shall be subject to approval of Owner/Architect/Engineer.
- B. Testing Laboratory Specifications: The Contractor shall obtain approval from the Owner/Architect/Engineer for the (GE) and the Testing Laboratory prior to beginning work.
- C. Field Testing: Allow testing laboratory to test and approve each subgrade and fill layer before further backfill or construction is performed.
  1. Field density tests shall be in accordance with ASTM D 698.
  2. The placement, location, number, and frequency of tests shall be as directed by the Geotechnical Engineer or authorized qualified Technician (GE or GT.)

#### 1.07 SUBMITTALS

- A. Test reports: Submit the following test reports directly to the Architect, Engineer, and Owner or Owner's representative from the Testing Laboratory, with a copy to the Contractor:
  - 1. Test reports on borrow material.
  - 2. Field reports, in-place soil density tests.
  - 3. One optimum moisture-maximum density curve for each soil type encountered.
  - 4. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.
  - 5. Topographic as-built survey (2.04 F)

## PART 2 - EXECUTION

### 2.01 ROUGH GRADING

- A. Definition: Cutting, grading, filling, and rough contouring the site for building pads, structures, paving areas, or other improvements.

### 2.02 EXAMINATION

- A. All existing contours, elevations, structures, utilities, and other improvements shown on the plans are taken from the best information available at the time and are believed to be reasonably true and correct. Any errors, omissions, or discrepancies between the actual field conditions and the plans discovered during construction must be reported immediately to the Architect and the Engineer. Any work done by the Contractor after such discovery without written approval from the Architect or Engineer will be at the Contractor's risk.

### 2.03 PREPARATION

- A. Identify and verify required lines, levels, contours, and datum.
- B. Utilities: Stake and flag locations of all utilities. Coordinate with all utilities and have existing locations clearly marked prior to construction. Protect above and below grade utilities to remain from damage. Notify prior to construction and coordinate with any utilities that will require removal and/or re-location.
- C. Provide protective measures or devices for all existing features to remain, including but not limited to: trees and vegetation, existing

buildings and appurtenances, adjacent property improvements, or other structures.

## 2.04 EXCAVATION

- A. General: Comply with safety requirements of all Federal, State, County, City, or local authorities having jurisdiction.
- B. Excavate subsoil as shown on approved plans. Make grade changes gradual. Blend slopes into level areas.
- C. EARTHWORK VOLUME(S) FOR CUT AND FILL WILL NOT BALANCE. The contractor is solely responsible for establishing finished grades as shown on approved plans, including any earthwork export (haul-off) or earthwork import (offsite hauled in) required to establish permanent grades. All exported earthwork shall be disposed of offsite in a legal manner by the contractor. All imported earthwork shall be approved suitable material documented by the GE for conformity with specifications, intended use, and volume(s) imported.
- D. Provide Temporary Dewatering as required to facilitate all proposed earthwork and construction. See Dewatering specifications.
- E. Tolerances: Top surface of subgrade: Plus or minus 1/10 foot, provided positive drainage is established according to the design intent of the plans and specifications.
- F. As-Built topographic survey:  
After rough grades are established, and before building foundations or other site improvements begin, the Contractor shall provide to the Owner at Contractor's expense an as-built topographic survey of the grades and graded areas as shown on the approved plans. The as-built topographic survey must be signed and sealed by a registered Surveyor licensed in the State where the project is located, and must show grading elevations, slopes, and contours to the extent necessary for the Owner to verify that the grading is in compliance with the approved plans and specifications. Do not proceed with any work in any area of the site until Owner is satisfied with results of as-built topographic survey. It is the Contractor's responsibility to schedule the as-built survey and account for the required time to complete the review process with the Owner to avoid delays to the project schedule.

- G. All soils used for fill in earthen dams or water impoundment areas shall be ML or CL low plasticity clays per the Unified Soil Classification, and must be approved by the Geotechnical Engineer. All organics, topsoil, or other unsuitable material shall be removed from the entire fill area. All fill shall be placed in maximum 6 inch lifts, minimum compaction is 95% of standard maximum density. No gravel, aggregate or gravel pipe bedding, or any pervious material shall be placed in the dam or fill area(s) or adjacent to any water impoundment perimeter(s). Scarify existing subgrade prior to placing fill.

## 2.05 ROCK EXCAVATION

- A. Rock excavation shall consist of all material which cannot be excavated except by drilling, blasting or wedging. It shall consist of undecomposed stone hard enough to ring under a hammer, and the amount of solid stone shall be not less than one (1) cubic yard in volume. Rock is further defined as follows:
  - 1. General Excavation: Any material occupying an original volume of more than one cubic yard which cannot be excavated with a single-tooth ripper drawn by a crawler tractor having a minimum draw bar pull rated at not less than 80,000 pounds sable pull (Caterpillar D-8 or larger), see 2.05(B).
  - 2. Trench Excavation: Any material occupying an original volume of more than one half cubic yard which cannot be excavated with a backhoe having a bucket curling force rated at not less than 40,000 pounds, using a rock bucket and rock teeth (a John Deere 790 or larger).
- B. When rock is encountered, the earth shall be cleared away and any rock shall be exposed for classification.

### **Rock must be classified and verified as follows:**

**In the presence of the Owner, Architect, Engineer, and the Testing Lab, at the expense of the Contractor, rock must be pulled in three different and distinct directions with a single-tooth ripper drawn by a crawler tractor having a minimum draw bar pull rated at not less than 80,000 pounds sable pull (Caterpillar D-8 or larger). After pulling in three different directions, rock shall be classified according to 2.05 (A) (1.)**

The Architect/Owner/Engineer shall be notified before any rock has been blasted or removed in any way.



- C. Boulders over one (1) cubic yard or rock as defined above shall be removed at a contractual unit price. Once rock is uncovered, grading sections shall be taken. When rock is completely removed, new grading sections shall be taken to determine the quantity of rock removed. Contractor shall bear the expense of taking grading sections.
- D. All blasting shall be done in accordance with local ordinances, and permits shall be obtained where required by law.
- E. Rock that is removed shall become the property of the Contractor and shall be removed from the site and/or buried as allowed by the specifications, and subject to GE approval.
- F. Decomposed rock and similar material that can be removed by tractor drawn ripper or power machinery as previously mentioned will be classified as earth excavation.
- G. When rock is encountered, clear away earth and notify Architect/Owner/Engineer. Architect/Engineer will inspect material and issue written instructions. No rock excavation shall be done without written instructions. No rock excavation shall be done prior to measurement.
- E. Measurement for Rock Excavation shall be as follows:
  - 1. Mass Rock:
    - a. Measurement for mass rock shall be made by taking cross sections or by other appropriate means identifying the contours of rock before and after removal. All rock measurements shall be made and certified by an independent licensed surveyor or engineer approved by the Architect.
    - b. Rock removed prior to measurement shall not receive compensation.
    - c. The quantity of rock shall be calculated using the following limits:
      - 1. To top of rock
      - 2. To 1.0 feet below finished grade of roadway
      - 3. To vertical lines at back of curb
      - 4. To 1.0 feet below foundations and footings
      - 5. To vertical faces located 1.0 feet horizontal distance from each footing or foundation face

6. To 0.5 feet below slabs on grade
7. To finish grade in cut where rock is removed to finish grade. Where it is not so removed, to the finish rock surface.

2. Trench Rock:

- a. Measurement for trench rock shall be made by taking level readings at reasonable intervals but not more than 10 feet along the exposed trench length before removal of rock. All rock measurements shall be made and certified by an independent licensed surveyor or engineer approved by the Owner/Architect.
- b. Rock removed prior to measurement shall not receive compensation.
- c. The quantity of rock shall be calculated using the following limits:
  1. To top of rock
  2. To vertical faces 1.0 feet beyond the outside of pipe barrel, each side
  3. To 12 inches below pipe barrel for the full trench length having rock
  4. To vertical faces located 1.0 feet horizontal distance beyond structures or manholes
  6. To 6 inches below bottom of slab for structures

E. Blasting or explosives:

1. All blasting or use of explosives shall be done by a company with at least five years documented experience specializing in use of explosives for disintegration of rock.
2. All blasting or use of explosives shall be done in strict accordance with the local authority having jurisdiction. Obtain all necessary permits or approvals prior to use of explosives. The Contractor is responsible for all Federal, State, and local safety requirements, ordinances, or laws regarding the use of explosives.
3. The Contractor shall conduct a survey with photographs of to document existing conditions of buildings adjacent to or near the location of rock removal prior to blasting. The Contractor shall advise and coordinate with all affected adjacent or nearby property owners in writing of the proposed blasting schedule.

Obtain a seismic survey prior to rock excavation to determine maximum charges which may be used without damaging adjacent property, buildings, or structures. Provide seismographic monitoring during all blasting operations.

4. All blasting shall be completed before footings or foundation construction begins.
5. Rock which is removed shall become the property of the Contractor and shall be removed from the site and disposed of in a legal manner.
6. When rock is encountered, the Contractor shall immediately notify the Engineer in writing. Classification of rock and volume calculations shall be done in accordance with the specifications and as directed by the Architect. The Engineer and/or the Architect will issue written instructions to the Contractor concerning rock work prior to any rock removal.
7. Payment will not be made for over excavated rock or for replacement materials.

## 2.06 BACKFILL AND FILL

- A. Fill materials: Fill shall be clean inorganic natural soil. Structural fill shall contain no rock fragments larger than 3 inches in the longest dimension. Soils proposed for fill shall have a target maximum dry density of 100 pounds per cubic foot or greater in Standard Proctor Compaction Test ASTM D698 or as directed by the GE. All fill materials must be approved by the Soils Engineer prior to placement. In the absence of a Soils Engineer, the Contractor is fully responsible for material or soil selected for fill. Any fill containing large quantities of rock or weathered rock shall not be used as structural fill.
- B. The Contractor shall coordinate testing as required by the Soils Engineer (GE) for all fill materials prior to their use.
- C. Execution: Placed fill materials used in backfilling or filling in layers shall not exceed the following loose depths or as directed by the Soils Engineer (GE):
  1. Heavy equipment compaction: 6-8 inches
  2. Hand operated tampers: 4-6 inches
- D. All areas of existing subgrade which require remediation, or are not

capable of in-place compaction, shall be excavated and backfilled with structural fill material compacted to a density equal to or greater than requirements for subsequent fill material layers.

- E. Place fill simultaneously on opposite sides of walls, small structures, utility lines, trenches, etc. to avoid displacement or over stressing.
- F. In-place density requirements:  
Compact soil to not less than the values given below, expressed as a percentage of maximum dry density at optimum moisture content per ASTM D698:
  - 1. Structural fill: Paved areas, buildings, footings, structures, etc.: 95 percent minimum unless noted otherwise, or as recommended by the Geotechnical Engineer or the Geotechnical subsurface exploration analysis and evaluation, whichever is greater.
  - 2. Unpaved non-structural areas: 90 percent
  - 3. Exterior steps, walks, ramps, etc.: 95 percent
  - 4. Compacted fill behind walls: 95 percent
- G. Moisture Control: During compaction, control moisture of subgrades and subsequent lifts to within optimum moisture content tolerances as recommended by the GE. Wet surface or aerate soil as required.
- H. Backfilling:
  - 1. Backfill areas to contours and elevations shown with approved unfrozen materials.
  - 2. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, or spongy subgrade surfaces.
  - 3. Maintain moisture content within optimum range as specified by the GE.
  - 4. Compaction: See 2.06 (F) above.
  - 5. Slope grades away from buildings or other structures which may be damaged by water a minimum of 2 inches in 10 feet, unless noted otherwise.
  - 6. Tolerances: Plus or minus 1/10 foot.
- I. Protection of finished work: Protect all finished work. Re-shape and re-compact fills subjected to vehicular traffic as necessary.

## 2.07 TRENCHING

- A. Comply with all Federal, OSHA, State, County, City or local regulations

regarding safety and construction. See Section 1.05 (4).

- B. Maintain and protect all utilities above and below ground designated to remain. Contractor to coordinate with all utilities and authorities having jurisdiction regarding construction procedures such as utility service connections, maintenance of service(s), notification procedures, tapping or extension specifications, and other related items.
- C. Cut trenches sufficiently wide to enable installation and inspection. The minimum bedding for all pipes is Class B as shown on the plans unless specified otherwise.
- D. Backfill trenches to correct elevations with approved materials only. Do not backfill over porous, wet, or spongy subgrade surfaces.
- E. Maintain maximum moisture content range to ensure required compaction density.

#### 2.08 DISPOSAL

- A. The contractor shall remove from the Owner's property all waste material, unsuitable excavated material, trash and debris, and dispose of it offsite in a legal manner.

#### 2.09 GEOTECHNICAL SOILS STUDY

- A. If a Geotechnical Soils Study has been performed, a copy of the Geotechnical Soils Study will be made available to the Contractor or included in the specifications following this Section. The Soils Study is for reference only. All conclusions, estimates, or decisions made regarding the contents of the Study are the sole responsibility of the person(s) reading the Study.

END OF SECTION 02200



## **SECTION 02230 ASPHALTIC CONCRETE PAVEMENT**

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. THIS SECTION INCLUDES:
  - 1. Aggregate materials
  - 2. Aggregate base course
  - 3. Asphaltic concrete pavement

#### 1.02 RELATED DOCUMENTS / SECTIONS

- A. Contract documents and drawings, State of Georgia Department of Transportation Standards and Specifications (GA DOT), current edition. Refer to appropriate related sections as applicable.

#### 1.03 REFERENCES

- A. AASHTO - M147 - Materials for aggregate and soil aggregate.
- B. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb. (4.45 kg) Rammer and an 18-in. (457 mm) drop.
- C. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Course Aggregates.
- D. ANSI/ASTM D698 - Standard Proctor Test - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using a 5.5 lb. (2.49 kg) Rammer and 12 inch (304.8 mm) drop.
- E. ANSI/ASTM D1557 - Modified Proctor Test - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.45 kg) Rammer and 18 inch (457 mm) Drop.
- F. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- G. ASTM D2487 - Classification of Soils for Engineering Purposes.
- H. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- I. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
- J. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- K. ANSI/ASTM D1556 - Test Method for Density of Soil using the Sand-Cone Method.

When standards or specifications are indicated herein by reference, the referenced portion shall apply to the most recent edition of the publication and shall have the same force and effect as if they were included herein in their entirety.

#### 1.04 PAYMENT ISSUE

- A. Materials testing to be done at Contractor's expense. Testing firm to be approved by Architect/Engineer.

#### 1.05 DESCRIPTION OF WORK

- A. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.

### PART 2 - PRODUCTS

#### 2.01 AGGREGATE MATERIALS

- A. Coarse Aggregate Type A (Gravel): AASHTO M147, Grade A; passing the No. 40 sieve with a liquid limit of not more than 25; a plasticity index of not more than 5 in accordance with ASTM D4318.
- B. Coarse Aggregate Type 2 (Gravel): Crushed: friable material and debris, graded in accordance with ANSI/ASTM C136, within the following limits:

Sieve Size	Percent Passing
2 inches	100
1 inch	95
3/4 inch	95 to 100
5/8 inch	75 to 100
3/8 inch	55 to 85
No. 4	35 to 60
No. 16	15 to 35
No. 40	10 to 25
No. 200	5 to 10

- C. Aggregate Type A3 (Pea Gravel): Natural Stone; washed, free of shale, clay, organic matter; graded in accordance with ANSI/ASTM C136; to the following limits:
  - 1. Minimum Size: 1/4 inch
  - 2. Maximum Size: 5/8 inch
- D. Fine Aggregate Type A4 (Sand): Natural river or bank sand; washed, free of silt, clay, loam, friable or soluble materials, and organic matter, graded in accordance with ANSI/ASTM C136; within the following limits:



Sieve Size	Percent Passing
No. 4	100
No. 14	50 to 85
No. 50	10 to 30
No. 100	2 to 10
No. 200	0

## 2.02 SOURCE QUALITY CONTROL

- A. Tests and analysis of aggregate materials will be performed in accordance with ANSI/ASTM D698.
- B. If tests indicate materials do not meet specified requirements, change material and re-test.

## PART 3 - PREPARATION

### 3.01 STOCKPILING

- A. Stockpile materials in sufficient quantities to meet construction schedules and requirements.
- B. Separate differing materials with dividers or stockpile apart to prevent mixing.
- C. Direct surface water away from stockpile site so as to prevent erosion.

## PART 4 - EXECUTION

### 4.01 AGGREGATE BASE COURSE

- A. Coarse Aggregate Fill Type A: As specified in 2.01.
- B. Fine Aggregate (Sand) Fill Type A4: As specified in 2.01.

### 4.02 EXAMINATION

- A. Verify substrate has been inspected, gradients and elevations are correct, and dry.

### 4.03 AGGREGATE PLACEMENT

- A. Spread aggregate over prepared substrate to an equivalent compacted

thickness as shown on the plans.

- B. Place aggregate in maximum 6 inch layers and roller compact.
- C. Level and contour aggregate surfaces to elevations and gradients indicated on the approved plans.
- D. Add small quantities of fine aggregate to course aggregate as appropriate to assist compaction.
- E. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

#### 4.04 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straightedge. Positive drainage must be maintained, no ponding or depressed areas, sharp transitions, or other objectionable areas will be allowed.
- B. Compacted thickness for each asphaltic concrete course: Within 1/8 inch, tolerance is not cumulative. Maximum deviation for total asphaltic concrete thickness: Within 1/4 inch regardless of number of courses. Positive drainage must be maintained, no ponding or depressed areas, sharp transitions, or other objectionable areas will be allowed.
- C. Variation from true elevation: Within 1/4 inch. Positive drainage must be maintained, no ponding or depressed areas, sharp transitions, or other objectionable areas will be allowed.

#### 4.05 FIELD QUALITY CONTROL

- A. Compaction testing, locations, number and frequency of tests shall be as recommended by the GE. Compaction testing shall be in accordance with ANSI/ASTM D1556.
- B. If tests indicate Work does not meet specified requirements, remove Work, replace, and re-test.

#### 4.06 COMPACTION

- A. Under paved areas:

1. Compact placed aggregate materials to achieve minimum 95 percent ASTM D698 compaction or as shown on plans.

#### 4.07 ASPHALTIC CONCRETE PAVING

##### A. RELATED DOCUMENTS / SECTIONS

1. Refer to related sections as applicable.
2. Aggregate Base Course and Aggregate Materials.

##### B. REFERENCES

1. MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot Mix Types - The Asphalt Institute (AI).
2. MS-3 - Asphalt Plant Manual - The Asphalt Institute (AI).
3. MS-8 - Asphalt Paving Manual - The Asphalt Institute (AI).
4. MS-17 - Asphalt Overlays for Highway and Street Rehabilitation - The Asphalt Institute (AI).
5. MS-19 Basic Asphalt Emulsion Manual, The Asphalt Institute (AI).
6. ASTM D946 - Penetration-Graded Asphalt Cement for Use in Pavement Construction.

##### C. PAYMENT ISSUE

1. Materials testing to be done at the contractor's expense. Testing firm to be approved by Architect/Engineer/engineer.

##### D. QUALITY ASSURANCE

1. Perform Work in accordance with AI Manual MS-8 unless the GA DOT specifications conflict.
2. Mixing Plant: Conform to AI Manual MS-3.
3. Obtain materials from same source throughout.

##### E. SUBMITTALS

1. Material Certificates: Provide copies of materials certificates

signed by material producer and Contractor, certifying that each material item complies with or exceeds, specified requirements.

F. SITE CONDITIONS

1. Weather Limitations: Apply prime and tack coats when ambient temperature is above 50 deg. F (10 deg.C), and when temperature has not been below 35 deg. F (1 deg. C) for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture. Construct asphalt concrete surface course when atmospheric temperature is above 40 deg. F (4 deg.C), and when base is dry. Base course may be placed when air temperature is above 30 deg. F (-1 deg. C) and rising.
2. Grade Control: Establish and maintain required lines and elevations.

G. DEFINITIONS

1. Asphalt Wearing Course: The top course of an asphalt pavement.
2. Asphalt Binder Course: The course located between a base course and the wearing course.
3. Base Course: The layer of material immediately beneath the binder course.

H. MATERIALS

1. Asphalt Cement: ASTM D946.
2. Aggregate for Binder Course Mix: (Heavy Duty asphaltic concrete type B) (Light Duty asphaltic concrete type B) in accordance with GA DOT standards.
3. Aggregate for Wearing Course Mix: In accordance with GA DOT standards.
4. Aggregate for Base Course: The base course shall be spread evenly upon the prepared subgrade in sufficient quantity to form a compacted depth as shown on the plans.
5. New topping for existing asphalt pavement as shown on the plans.
6. Fine Aggregate: In accordance with the GA DOT standards.

7. Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.

I. ACCESSORIES

1. Primer: In accordance with the GA DOT standards.
2. Tack Coat: In accordance with the GA DOT standards.

J. ASPHALT PAVING MIX

1. Use dry material to avoid foaming. Mix uniformly.
2. Binder Course: Per GA DOT specifications.
3. Wearing Course: Per GA DOT specifications.
4. The contractor shall submit to the Engineer a design mix for each course specified a minimum of two weeks prior to commencing work.

K. SUBBASE

1. Aggregate Base Course forms the base construction for work of this Section.

L. PREPARATION - PRIMER

1. Apply primer on base or subbase over subgrade surface at uniform rate of 1/3 gal/sq yd.
2. Apply primer to contact surfaces of curbs, gutters.
3. Use clean sand to blot excess primer.

M. PREPARATION - TACK COAT

1. Apply tack coat on asphalt or concrete surfaces over subgrade at uniform rate of 1/3 gal/sq yd.
2. Apply tack coat to contact surfaces of curbs and gutters.

N. PLACING ASPHALT PAVEMENT

1. Install Work in accordance with GA DOT standards and specifications.
2. All areas where new asphalt adjoins existing asphalt or other pavement shall be sawcut for smooth edges and shall have expansion joints for entire adjoining length. All such expansion joints shall be completely and permanently sealed for entire length per standard details and GADOT standards and specifications. All such areas in right-of-way or other jurisdiction shall comply with the local authority specifications for material, depth, base, pavement thickness, finish, and specifications.

O. RESURFACING

1. Resurfacing and/or overlay topping of existing pavements shall be a minimum 1 1/2" type F asphalt surface course. Spot repairs, cleaning, and sealing of existing pavements shall be in accordance with "Asphalt Overlays for Highway and Street Rehabilitation" (MS-17), Asphalt Institute.

P. FIELD QUALITY CONTROL

1. General: Core Test in-place asphalt concrete courses for compliance with requirements for thickness and surface smoothness. Test locations shall be selected by Owner/Engineer. Coring(s) shall be repaired per referenced standards. Repair or remove and replace unacceptable paving as directed by Architect/Engineer.
2. Thickness: In-place compacted thickness will not be acceptable if exceeding following allowable variation from required thickness:
  - A. Base Course: 1/4 inch
  - B. Asphaltic concrete Binder and Surface Courses: 1/8 inch
  - C. Surface Smoothness: Test finished surface of each asphalt concrete course for smoothness, using 10' straightedge applied parallel with, and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness. All surfaces not acceptable shall be removed and replaced until acceptable.
    1. Base Course Surface: 1/4"
    2. Compacted thickness for each asphaltic concrete course: Within 1/8 inch, tolerance is not cumulative. Maximum deviation for total asphaltic concrete thickness: Within 1/4 inch regardless of number of courses. Positive drainage must be maintained, no ponding or depressed areas, sharp transitions, or other objectionable areas will be allowed.

3. Crowned Surfaces: Test with crowned template centered at right angle to crown. Maximum allowable variance from template 1/4". Positive drainage must be maintained, no ponding or depressed areas, sharp transitions, or other objectionable areas will be allowed.
4. Check surface areas at intervals as directed by Architect/Engineer/Engineer as necessary to insure conformance to the plans and specifications.

#### 4.08 ASPHALTIC CONCRETE OVERLAY PAVING

##### A. RELATED DOCUMENTS / SECTIONS

1. Refer to related sections as applicable.
2. Aggregate Base Course and Aggregate Materials.

##### B. REFERENCES

1. MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot Mix Types - The Asphalt Institute (AI).
2. MS-3 - Asphalt Plant Manual - The Asphalt Institute (AI).
3. MS-8 - Asphalt Paving Manual - The Asphalt Institute (AI).
4. MS-17 - Asphalt Overlays for Highway and Street Rehabilitation - The Asphalt Institute (AI).
5. MS-19 Basic Asphalt Emulsion Manual, The Asphalt Institute (AI).
6. ASTM D946 - Penetration-Graded Asphalt Cement for Use in Pavement Construction.

When standards or specifications are indicated herein by reference, the referenced portion shall apply to the most recent edition of the publication and shall have the same force and effect as if they were included herein in their entirety.

##### C. PAYMENT ISSUE

1. Materials testing to be done at the contractor's expense. Testing firm to be approved by architect/engineer.

##### D. QUALITY ASSURANCE

1. Perform Work in accordance with AI Manual MS-8 and the GA DOT specifications. Where conflicts occur, use the more stringent specification.
2. Mixing Plant: Conform to AI Manual MS-3.
3. Obtain materials from same source throughout.

E. SUBMITTALS

1. Material Certificates: Provide copies of materials certificates signed by material producer and Contractor, certifying that each material item complies with or exceeds, specified requirements.

F. SITE CONDITIONS

1. Weather Limitations: Apply prime, seal, and tack coats per manufacturer's specifications, but not less than the following: when ambient temperature is above 50 deg. F (10 deg.C), and when temperature has not been below 35 deg. F (1 deg. C) for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture. Construct asphalt concrete surface course when atmospheric temperature is above 40 deg. F (4 deg.C), and when base is dry. Base course may be placed when air temperature is above 30 deg. F (-1 deg. C) and rising.
2. Grade Control: Establish and maintain required lines and elevations.

G. DEFINITIONS

1. Asphalt Wearing Course: The top course of an asphalt pavement.
2. Asphalt Binder Course: The course located between a base course and the wearing course.
3. Base Course: The layer of material immediately beneath the binder course.
4. Asphalt Overlay Course: Asphaltic concrete course directly on top of existing asphalt pavement top course. Asphalt overlay is allowed only where specifically shown on plans.

H. MATERIALS

1. Asphalt Cement: ASTM D946.
2. Aggregate for Binder Course Mix: In accordance with GA DOT standards.



3. Aggregate for Wearing Course Mix: In accordance with GA DOT standards.
4. Aggregate for Base Course: The base course shall be spread evenly upon the prepared subgrade in sufficient quantity to form a compacted depth as shown on the plans.
5. Overlay for existing asphalt pavement only as shown and specified on the plans.
6. Fine Aggregate: In accordance with the GA DOT standards.
7. Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.

I. ACCESSORIES

1. Primer: In accordance with the GA DOT standards.
2. Tack Coat: In accordance with the GA DOT standards.

J. ASPHALT PAVING MIX

1. Use dry material to avoid foaming. Mix uniformly.
2. Binder Course: Per GA DOT specifications.
3. Wearing Course: Per GA DOT specifications.
4. Overlay Course: Per GA DOT specifications.
5. The contractor shall submit to the Engineer a design mix for each course specified a minimum of two weeks prior to commencing work.

K. ASPHALT OVERLAY PREPARATION - EXISTING PAVEMENT

1. The Contractor must perform a thorough inspection of all existing pavement areas designated for asphalt pavement overlay with the Architect/Engineer. Existing pavement areas which exhibit excessive wear, rutting, cracking, settling, or other defects must be repaired prior to installation of asphalt overlay. Repaired areas must meet project specifications for the entire pavement section including subgrade, base, and all asphalt pavement courses. Areas requiring repairs shall be determined by the Architect/Engineer.
2. CLEANING:  
Existing asphalt pavement shall be cleaned thoroughly. Saw cut pavement edges where pavement is to be removed. Clean all loose and objectionable material. Surface must be dry prior to

asphalt overlay pavement. Primer, sealer, reinforcement fabric, and tack coat are required prior to placement of overlay pavement.

3. **STRUCTURAL PATCHING:**  
Structural patching will be required where the following conditions occur: excessive wear of surface course, rutting, excessive cracking, local depressed areas, potholes, and similar defects in the existing pavement. All such areas in the existing pavement with defects shall be removed and repaired. Areas to be patched shall be cut out, trimmed to vertical sides, with all loose material or debris removed. Remove and replace subgrade and existing aggregate base material as required to provide a minimum pavement section equal to or greater than the pavement section specified for the project.
4. **LEVELING:**  
Leveling consists of asphalt wedges used to level existing pavement surfaces prior to asphalt overlay pavement installation. Leveling may be done ONLY in those areas where the existing base course and underlying subgrade meet the minimum pavement specifications for the project as determined by the Architect/Engineer. Leveling shall be done in at least two layers, maximum depth of 2 inches per layer, for up to 6 inches total depth. All layers shall be level with smooth transitions to existing pavement. Crowned areas shall be leveled all the way to the top of the crown, depressed areas shall be leveled to meet the existing edge of pavement adjacent to the depression. Leveling construction and materials shall conform to GA DOT specifications.
5. **CRACK SEALING:**  
All cracks in the existing pavement greater than 0.375 inches (3/8") shall be sealed with an appropriate crack filler prior to asphalt overlay pavement installation. After proper installation of crack filler material, all cracks in existing pavement shall be reinforced with Type II pavement reinforcement fabric per GA DOT standards and specifications. Crack filler and sealer material and construction shall conform to GA DOT specifications.
6. **TAPERING:**  
Asphalt pavement overlay adjacent to curbs, gutters, raised pavement edges, structures, drainage grates, manhole covers, or similar areas shall be constructed to provide a finished asphalt surface at the joint where the asphalt meets the existing structure no higher or lower than the existing or proposed structure elevation to provide a smooth even surface at all structures in or adjacent to the pavement. The asphalt overlay minimum thickness as specified shall be maintained. Existing pavement shall be removed as required to provide a finished surface at the edge of pavement adjacent to existing or proposed structures equal to the existing structure surface elevation. Do

not feather or taper the asphalt overlay. Maintain the minimum pavement thickness throughout.

7. STRUCTURE ADJUSTMENTS:

All structures in the pavement or touching pavement shall be adjusted, relocated, repaired, raised or lowered, and set into new pavement to ensure proper function for the structure. All joints and edges with existing pavement, curb, gutters, drainage structures, manholes, cleanouts, valves, and all other structures in the pavement overlay area, shall be even with the finished pavement surface including the overlay and uniform for the proper function of the structure. Removal of existing asphalt pavement will be required. Do not raise with the asphalt overlay any finished grades adjacent to buildings or structures which may be damaged by water intrusion. Maximum finished pavement grade adjacent to buildings or structures which may be damaged by water intrusion is 0.50 feet lower than the finished floor level of the building or structure. Existing grades adjacent to buildings which are less than 0.50 feet lower than the finished floor may be maintained at the existing elevation with Owner's approval under the following conditions: 1.) no water intrusion is present, with no history of water intrusion (Contractor must verify); 2.) Positive slope and drainage away from the building or structure must be maintained.

L. ASPHALT OVERLAY PREPARATION - PRIMER

1. Apply primer on base or subbase over surface at uniform rate per GA DOT specifications.
2. Apply primer to contact surfaces of curbs, gutters.
3. Use clean sand to blot excess primer.

M. ASPHALT OVERLAY PREPARATION - TACK COAT

1. Apply tack coat on asphalt or concrete surfaces over subgrade at uniform rate per GA DOT specifications.
2. Apply tack coat to contact surfaces of curbs and gutters. Install Type II pavement reinforcement fabric per GA DOT standards and specifications.

N. PLACING ASPHALT OVERLAY PAVEMENT

1. Install all Work in accordance with asphaltic concrete pavement specifications, and GA DOT standards and specifications.

O. RESERVED

P. FIELD QUALITY CONTROL

1. General: Test in-place asphalt concrete courses for compliance with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable paving as directed by Architect.
2. Thickness: In-place compacted thickness will not be acceptable if exceeding following allowable variation from required thickness:
  - A. Base Course: 1/2", plus or minus
  - B. Surface Course: 1/4", plus or minus
  - C. Overlay Course: 1/4", plus or minus
  - D. Surface Smoothness: Test finished surface of each asphalt concrete course for smoothness, using 10' straightedge applied parallel with, and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness. All surfaces not acceptable shall be removed and replaced until acceptable.
    1. Base Course Surface: 1/4"
    2. Wearing Course Surface: 1/8"
    3. Crowned Surfaces: Test with crowned template centered at right angle to crown. Maximum allowable variance from template, 1/4".
    4. Check surface areas at intervals as directed by Architect or as necessary to insure conformance to the plans and specifications.

END OF SECTION 02230

**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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Davis Elementary School

SECTION 02361  
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- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 02361



## **SECTION 02510 - PORTLAND CEMENT CONCRETE PAVING**

### **PART 1 - GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Concrete Curbs
- B. Concrete Sidewalks, pads & steps
- C. Concrete Paving, footings, foundations, slabs

#### **1.02 RELATED SECTIONS**

- A. Refer to appropriate related sections as applicable

#### **1.03 REFERENCES**

- A. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
- B. ACI 305R - Hot Weather Concreting.
- C. ACI 306R - Cold Weather Concreting.
- D. ACI 308 - Standard Practice for Curing Concrete.
- E. ACI 318 - Building Code Requirements for Reinforced Concrete.
- F. ANSI/ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous Type).
- G. ANSI/ASTM D1190 - Concrete Joint Sealer, Hot-Poured Elastic Type.
- H. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
- I. ASTM C33 - Concrete Aggregates.
- J. ASTM C94 - Ready-Mixed Concrete.
- K. ASTM C150 - Portland Cement.
- L. ASTM-C260 - Air Entraining Admixtures for Concrete.
- M. ASTM C494 - Chemicals Admixtures for Concrete.
- N. ACI 301 - Specifications for Structural Concrete

When standards or specifications are indicated herein by reference, the referenced portion shall apply to the most recent edition of the publication and shall have the same force and effect as if they were included herein in their entirety.

#### **1.05 QUALITY ASSURANCE**

- A. Perform work in accordance with ACI 301.
- B. Maintain one copy of each document on site.

- C. Acquire cement and aggregate from same source for all work.
- D. Conform to ACI 305R when concreting during hot weather.
- E. Conform to ACI 306R when concreting during cold weather.

#### 1.06 DESCRIPTION OF WORK

- A. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.

### PART 2 - PRODUCTS

#### 2.01 CONCRETE TYPES

- A. Class A and B Concrete.

#### 2.02 MATERIAL

A.	CLASS A	CLASS B
Coarse Aggregate Size No.	56, 57, 67	56, 57, 67
Minimum Cement Factor (lbs / cu yd)	611	470
Maximum Water / Cement Ratio (lbs / cu yd)	0.490	0.660
Slump Acceptance Limits (in. lower - upper)	2 - 4	2 - 4
Entrained Air Acceptance Limits (% lower - upper)	2.5 - 6.0	0.0 - 6.0
	CLASS A	CLASS B
Minimum Compressive Strength 28 Days (psi)	3000	2500
B. Refer to GA DOT standards and specifications.		
C. Minimum compressive strength shall be as stated on plans.		

## 2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I - Normal.
- B. Fine and Coarse Aggregate : ASTM C33.
- C. Water: Clean and not detrimental to concrete.

## 2.04 CONCRETE MIX

- A. Mix concrete in accordance with ACI 304. Deliver concrete in accordance with ASTM C94.
- B. Select proportions for normal weight concrete in accordance with ACI 301 Method 1.
- C. No mixing onsite will be allowed, no fly ash or other additives will be allowed, water shall not be added after initial mixing at plant. Concrete older than 90 minutes from initial mixing at plant shall not be used.

# PART 3 - EXECUTION

## 3.01 EXAMINATION

- A. Verify all formwork is correctly installed and located.
- B. Verify requirements for concrete cover over reinforcement.

## 3.02 PREPARATION

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

## 3.03 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304. Fully comply with ACI 305R (Hot weather concreting) and ACI 306R (Cold weather concreting).
- B. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints are not disturbed during concrete placement.
- C. Install joint devices in accordance with manufacturer's instructions.
- D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- E. Place concrete continuously between predetermined expansion, control, and construction joints.

## 3.04 RESERVED

## 3.05 CONCRETE FINISHING

- A. Broom finish surfaces which are scheduled to be exposed or as directed by the Architect or shown on the plans. Verify required finish with Architect and Owner prior to construction.

### 3.06 CURBING AND PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

### 3.07 FIELD QUALITY CONTROL

- A. Field testing will be performed in accordance with ACI 301.

### 3.08 PATCHING

- A. Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.
- B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect/Engineer upon discovery.

### 3.09 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Repair or replacement of defective concrete will be determined by the Architect/Engineer.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

### 3.10 SIDEWALKS

- A. Walks shall be constructed of Class B concrete, and shall be minimum four (4") inches depth. Provide cross slope (perpendicular to travel path) of minimum 1/8 inch per foot (1.0%) to maximum 1/4 inch per foot (2.0%). Cross slope shall direct flow to drainage channels, storm sewer, or free discharge. No ponding allowed. All sidewalks shall have minimum 6x6 10 Gauge welded wire fabric reinforcement placed at 1.5 inches from bottom of concrete, with subgrade compacted to minimum 95 percent maximum dry density. Transverse contraction joints shall be formed with tool designed for forming groove one-third of the depth of the sidewalk, and located as shown on the architectural drawings, or at

a minimum of twice the sidewalk width, or 10 feet maximum. All edges shall be rounded with a 1-1/4" edger. Full depth expansion joints shall be located on not more than 20'-0" centers and at all intersections. All sidewalk surfaces should be broom finished or as directed by Architect/Engineer or as shown on plans. Verify finish prior to construction.

### 3.11 CURBS

- A. Curbs shall be constructed of Class A concrete and all curbing shall be placed in compacted subsoil meeting specifications. Curbing shall be as shown on plans. Transverse contraction joints shall be formed with tool designed for forming groove, and on no more than 6'-0" centers. Expansion joints shall be located on not more than 20'-0" centers and at all intersections.
- B. Gutter cross section slope shall be adjusted at low points and as required to meet design intent for drainage and flow direction. At upstream low point sections the gutter cross slope shall be sloped in the direction of flow and blended smooth with adjacent curb and gutter. No ponding will be allowed in any gutter section.

### 3.12 CONCRETE PADS & STEPS

- A. Shall be constructed of Class A concrete. Concrete reinforcement according to construction details, minimum 6x6 10 gauge welded wire fabric. All concrete pads poured at entrance or exit doorways or access points shall be poured to the finish floor level at the interface with the building, and immediately sloping away from the building at a rate of 1/8 inch per foot or 1.0 percent minimum, 1/4 inch per foot maximum. Provide positive slope away from building or structure at all points, no ponding or depressed areas will be allowed.

END OF SECTION 02510



## **SECTION 02580 - PAVEMENT MARKING AND TRAFFIC SIGNS**

### **PART 1 - GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Parking striping and direction markings on asphalt concrete.
- B. Signage for directing traffic on the site.

#### **1.02 SUBMITTALS**

- A. Product data: Submit for marking paint to Architect. Indicate application rates and methods.
- B. Proposed Sign Samples to Owner/Architect.

#### **1.03 REFERENCES**

- A. Georgia Department of Transportation Standards and Specifications
- B. Manual on Uniform Traffic Control Devices (MUTCD)

When standards or specifications are indicated herein by reference, the referenced portion shall apply to the most recent edition of the publication and shall have the same force and effect as if they were included herein in their entirety.

#### **1.04 JOB CONDITIONS**

- A. Weather Limitations:
  - 1. Apply pavement marking paint only when ambient temperature in the shade is at least 50 degrees F for 12 hours immediately prior to application.
  - 2. Do not apply when surface is wet or contains moisture.
  - 3. Do not apply paint when wind conditions would result in debris being deposited on painted surfaces.

#### **1.05 DESCRIPTION OF WORK**

- A. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.

### **PART 2 - PRODUCTS**

#### **2.01 PAVEMENT MARKING PAINT**

- A. Traffic lane, parking stall, handicap parking and direction arrow marking: Type meeting GA DOT Specification, current edition.
- B. Qualities: Quick drying colors as specified by Architect.
- C. Source:
  - 1. Sherglide by Sherwin-Williams or equivalent.

## 2.02 DIRECTIONAL SIGNAGE

- A. All signage used on the site to direct traffic shall conform to the Manual for Uniform Traffic Control Devices, and the GA. D.O.T. Standards and Specifications, current edition, and be approved by the Owner/Architect prior to installation. Contractor shall provide Owner/Architect with samples and shop drawings of these signs.

## 2.03 HANDICAP PARKING SIGNS

- A. Contractor shall provide and erect all required handicap signage required for the site according to federal, state, county and city authorities standards and specifications whether shown on the plans or not.

# PART 3 - EXECUTION

## 3.01 MARKING PAVEMENTS

- A. All pavement markings used on the site to direct traffic shall conform to the Manual for Uniform Traffic Control Devices, and the GA. D.O.T. Standards and Specifications, current edition, as approved by the Owner/Architect. Contractor shall provide Owner/Architect with samples and shop drawings of all markings prior to construction, Paint lines as shown on approved drawings.
- B. Cleaning: Sweep surface with power broom supplemented by hand brooms to remove loose material and dirt. Do not begin pavement marking until substrate has cured.
- C. Apply paint with mechanical equipment to uniform straight line. All linework not otherwise indicated shall be 4" uniform thickness, color white. All directional markings shall be painted with spray equipment on stencils or templates of approved design to prevent overspray. Apply one coat in accordance with manufacturer's recommended rates to achieve minimum 15 mils dry film thickness.

END OF SECTION 02580



## **SECTION 02700 - STORM SEWER**

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Site storm sewer drainage piping, structures, fittings, accessories, and pipe bedding.
- B. Catch basins, manholes at junctions, inlets, structures and appurtenances as shown on the plans.

#### 1.02 RELATED DOCUMENTS/SECTIONS

- A. Contract documents and drawings, construction details as shown on the plans, geotechnical engineering report, GA. D.O.T. Standards and Specifications. Refer to appropriate related sections as applicable.

#### 1.03 REFERENCED STANDARDS

- A. AASHTO M36 - Metallic (Zinc or Aluminum) Coated Corrugated Steel Culverts and Underdrains.
- B. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.
- C. ANSI/ASTM A74 - Cast Iron Soil Pipe and Fittings.
- D. ANSI/ASTM C12 - Practice for Installing Vitrified Clay Pipe Lines.
- E. ANSI/ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.
- F. ANSI/ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- G. ANSI/ASTM C425 - Compression Joints for Vitrified Clay Pipe and Fittings.
- H. ANSI/ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- I. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- J. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12

inch (304.8 mm) Drop.

- K. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb(4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- L. ANSI/ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
- M. ANSI/ASTM D2729 - Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- N. ANSI/ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- O. ANSI/ASTM D3033 - Type PSP Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- P. ANSI/ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- Q. ASTM C700 - Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.
- R. ASTM D2922 - Test Methods for Density of Soil and Soil- Aggregate in Place by Nuclear Methods (Shallow Depth).
- S. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

When standards or specifications are indicated herein by reference, the referenced portion shall apply to the most recent edition of the publication and shall have the same force and effect as if they were included herein in their entirety.

#### 1.04 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations. All bedding and trenching shall conform to the details shown on the construction plans. Any wet, spongy, or other unsuitable material shall be removed and/or stabilized at the direction of the soils engineer.

#### 1.05 SUBMITTALS

- A. Provide data indicating pipe, pipe accessories, and manufacturer's

warranties.

- B. Manufacturer's Installation Instructions: Indicate special procedures required to install products specified.
- C. Manufacturer's Certificate: Certify that products meet or exceed specifications and/or referenced standards.
- D. Pre-manufactured catch basins, trench drains or other special drainage equipment: Submit to Engineer manufacturer's shop drawings, specifications, and warranties for approval prior to purchase or installation.

#### 1.06 PROJECT RECORD DOCUMENTS

- A. Submit complete, detailed as built drawings to Owner, Engineer, and Architect upon completion of the work showing vertical and horizontal location. As built drawings shall be based on field run survey(s) and be sealed and signed by a registered surveyor in the State where the project is located. Provide three sets of original hard copies and one digital file in AutoCad or other acceptable digital format. Contractor is responsible for approval and verification of acceptable digital format. **As-built drawings will be required at a minimum 45 days prior to substantial completion.**
- B. Accurately record actual locations of pipe runs, taps, connections, valves, tees, mechanical joints, connections, pipes, manholes, structures, sub-surface drain fields, septic tanks, lift stations, service taps or stubouts, type and size of material, and top and invert elevations of all pipes and structures.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities or other structures. All such uncharted utilities or structures shall be shown on as built drawings.

#### 1.07 REGULATORY REQUIREMENTS

- A. Conform to all applicable Federal, State, County, City, or local jurisdiction requirements concerning storm sewer construction and safety.

#### 1.08 FIELD MEASUREMENTS

- A. Verify that field measurements and elevations are as indicated by the manufacturer.

## 1.09 COORDINATION

- A. A. Coordinate the Work with plumbing contractor and MEP engineering plans for connection of storm sewer to foundation drainage system and roof drainage system outside building. Verify and confirm positive drainage and slope for all Roof drain stubs connection to storm sewer prior to construction (PTC).

## 1.10 DESCRIPTION OF WORK

- A. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.

## PART 2 - PRODUCTS

### 2.01 STORM SEWER PIPE MATERIALS

- A. All storm sewer structures, manholes, junctions, piping, joints, sealing, materials and installation shall conform, at a minimum, to the local authorities having jurisdiction standards and specifications and current Georgia Department of Transportation (GDOT) latest standards and specifications, and as specified herein, whichever is greater. The Contractor is responsible for verification of current applicable standards and specifications prior to construction. All manhole or other junction structures shall have with paved invert channels per current GDOT standards and specifications.
- B. Storm Sewer Pipe:  
All storm sewer pipe gauge shall conform at minimum to GDOT 1030D, 1030P, current revision, and pipe manufacturer's specifications, whichever is greater. All storm sewer pipe, materials, joints, and installation is subject to the approval of the local authority having jurisdiction approval. Contractor shall verify local authority specifications and requirements prior to purchase. All storm sewer (except concrete) carrying live streams or used for storm water detention shall have paved invert.
- C. Reinforced Concrete Pipe: ANSI/ASTM C76, Class III, with Wall Type A, mesh reinforcement; bell and spigot end joints. Verify Class per GADOT 1030D.

- D. Reinforced Concrete Pipe Joint Device: ANSI/ASTM C443, rubber compression gasket joint.
- E. Corrugated Steel Pipe: AASHTO M36 Type I, helical lock seam, coated inside and out with 0.050 inch (1.3 mm) thick bituminous coating.
- F. Coupling Bands: Galvanized steel, 0.052 inches (1.3 mm) thick x 10 (250 mm) inches wide; connected with two neoprene "O" ring gaskets and two galvanized steel bolts.
- G. HDPE Pipe:  
Shall conform to: ASTM D4101, ASTM F677, ASTM D3212, ASTM F477, ASTM D2321, AASHTO M294.  
Contractor shall comply fully with all manufacturer's specifications and as specified herein, whichever is greater, including but not limited to: subgrade, bedding, joints, backfill, installation and handling procedures.  
Minimum HDPE requirements:  
Smooth bore dual wall pipe is minimum requirement.  
All HDPE pipe installation shall be monitored and certified by Geotechnical Engineer or other testing agency approved by Engineer / Architect.  
Provide submittal to Engineer for approval prior to purchase.  
Maintain minimum HS20 load rating at all times.  
Watertight bell and spigot gasketed joints required.  
Granular backfill conforming to ASTM D2321 Class I (AASHTO M43 Designation #5 or # 56 stone) shall be installed minimum 6 inches below pipe to 12" over top of pipe, minimum compaction 90% ASTM D698, or per manufacturer, or as shown on plans, whichever is greater. Contractor shall verify all bedding requirements prior to construction.  
Backfill shall be distributed and placed with shovels or other light hand tools to completely fill all voids in and around the pipe and the backfill area at the required density for compaction specified. No heavy equipment shall be used adjacent to or near the pipe until minimum cover is established as noted below.  
Geotextile fabric shall be installed at the interface between adjacent soil and the granular backfill below, on the sides, and at the top of the backfill trench. Verify type of geotextile with Geotechnical Engineer prior to construction.  
Heavy equipment or vehicles are not allowed over HDPE pipe prior to minimum 24 inches compacted cover (or per manufacturer specifications, whichever is greater) over top of pipe is established per design and specifications.  
Minimum and maximum cover depth shall be verified by Contractor with manufacturer based on design, site conditions, manufacturer specifications, and contract documents, plans, and specifications.  
Contractor shall verify that site soil conditions meet manufacturer's

specifications for pH and resistivity prior to purchase.

Contractor shall provide testing and certification of all HDPE pipe installation for deflection and structural integrity after finish grades are established and construction is complete by Geotechnical Engineer or other testing agency approved by Engineer / Architect.

- H. Aluminum Coated Type 2 Corrugated Steel Pipe:  
Shall conform to: AASHTO M36, AASHTO M274  
Contractor shall comply fully with all manufacturer's specifications, including but not limited to: bedding, joints, backfill, and installation and handling procedures.  
Minimum pipe thickness is 12 gauge. Comply GADOT 1030D and manufacturer's specifications for pipe gauge, depths and design conditions.  
Provide submittal to Engineer for approval prior to purchase.  
Maintain minimum H20 load rating at all times.  
Granular backfill of maximum 1 inch diameter to 1/2 pipe diameter required.  
Contractor shall verify that site soil conditions meet manufacturer's specifications for pH and resistivity prior to purchase.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Verify that trenches, excavations, dimensions, bedding, fill materials, and elevations conform to the plans and specifications and are ready to receive the work.
- B. Contractor shall verify all existing storm sewer pipe, structures, and other utilities location, depth, invert, material, size, and condition **PRIOR TO CONSTRUCTION**. Contractor shall verify connection locations and inverts to existing storm sewer pipe or structures **PRIOR TO CONSTRUCTION**. Resolve any conflicts or problems prior to proceeding with the work.

#### 3.02 PREPARATION

- A. Hand trim excavations to required elevations. Correct over-excavation with fine aggregate or as directed by the contracting officer. Verify all fill material as suitable with the soils engineer prior to placement and compaction.
- B. Remove large stones, debris, rock, roots, organic material, or other hard matter which could damage piping or impede consistent backfilling or

compaction.

### 3.03 BEDDING

- A. Excavate pipe trench in accordance with Section 02200 for work of this section. Hand trim excavation for accurate placement of pipe to elevations indicated. Cut trenches sufficiently wide to enable installation and inspection. The minimum bedding for all pipes is Class B unless specified otherwise.
- B. Pipe bedding is required for all storm sewer. Where not specified on the plans, Class B Bedding will be required. Do not place aggregate or stone bedding for any storm sewer or storm structure in or within 20 linear feet of any dam, pond, or water impoundment area. Place bedding material at trench bottom, level materials in continuous layers not exceeding 6 inches compacted depth. Minimum compaction for pipe trenches is 95% of standard proctor or greater as directed by the soils engineer.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.

### 3.04 INSTALLATION - STORM SEWER

- A. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal joints watertight.
- B. Lay pipe to slope gradients noted on drawings.
- C. Install pipe bedding aggregate at bottom, sides and over top of pipe where required and as shown on the drawings. Do not place aggregate or stone bedding for any storm sewer or storm structure in or within 20 linear feet of any dam, pond, or water impoundment area. Provide top cover to minimum compacted thickness of 12 inches, compact to minimum 95% standard proctor.
- D. Refer to Section 02200 for trenching requirements. Do not displace or damage pipe when compacting.
- E. Refer to Section 02200 for field testing requirements for fill materials.

### 3.05 INSTALLATION – MANHOLES, JUNCTIONS, STRUCTURES

- A. All manholes, junctions, or structures shall be precast reinforced concrete. Brick structures will not be allowed. Set all structures plumb.

All structures shall have inverts to provide positive flow and prevent any ponding of water. Install per manufacturer's specifications.

- B. All grout shall be nonmetallic, non-shrink cementitious type flowable expansive grout with minimum 28 day compressive strength of 6500 psi, conforming to ASTM C 1107, verify Type for field conditions prior to construction. Voids or gaps which exceed the maximum allowed for grout by the manufacturer specifications will require a structural repair or replacement as directed by the Engineer. Comply fully with grout manufacturer's specifications.
- C. Manhole, junction, or structure riser sections shall be watertight and sealed per manufacturer's specifications and reference standards using preformed resilient gaskets. Joints between manholes or structures and base sections shall be grouted on the inside to provide a smooth surface. Manhole sections shall grouted to ring and covers on the inside.
- D. All pipe or other penetrations into manholes, structures, or junctions shall be permanently sealed watertight. Fill all spaces between pipe or other connections and manholes, junctions, or structures completely with non-shrink cementitious concrete grout placed on inside and outside of manhole or structure, completely filling all voids. The exterior wall of the manhole or structure shall have a minimum 6 inch thick 2500 psi concrete collar poured tightly around the entire pipe perimeter and tight to the exterior wall, minimum extension past the pipe shall be 12 inches. Grout shall have minimum 28 day compressive strength of 6500 psi, installed in strict compliance with manufacturer's specifications.

### 3.06 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 02200.
- B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest, until the work meets specified requirements.
- C. Frequency of Tests: As directed by the soils engineer (GE).

### 3.07 PROTECTION

- A. Protect finished Work from damage during construction. Damaged work shall be replaced at the expense of the contractor.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.



- C. All storm sewer structures, pipe, connections, and appurtenances shall be thoroughly cleaned and free of silt, sediment, soil, debris, trash, or any unsuitable materials or obstructions. This is the sole responsibility of the Contractor.

END OF SECTION 02700



## **SECTION 02713 - WATER SYSTEM**

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Pipe and fittings for site water line including domestic water line and ductile iron pipe water line.
- B. Valves, fire hydrants if required, and domestic water hydrants.

#### 1.02 RELATED DOCUMENTS/SECTIONS

- A. Contract documents and drawings, construction details as shown on the plans, geotechnical engineering report. Refer to appropriate related sections as applicable.

#### 1.03 REFERENCE STANDARDS

- A. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.
- B. ANSI/ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.  
ASME B1.20.1 - Pipe Threads, General Purpose (Inch)  
ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings
- C. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- D. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- E. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- F. ANSI/ASTM D2466 - Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- G. ANSI/AWS A5.8 - Brazing Filler Metal.
- H. ANSI/AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
- I. ANSI/AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and other liquids.
- J. ANSI/AWWA C111- Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.

- K. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- K1. ASTM A536 – Ductile Iron MJ Fittings  
ASTM A48 - Specification for Gray Iron Castings  
ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped Zinc - Coated Welded and Seamless (Replaces A120)
- K2. ANSI/AWWA C110, C153 – Ductile Iron MJ Fittings  
  
AWWA C115 - Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges  
  
AWWA C116 - Standard for Protective Fusion-Bonded Epoxy Coating for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service
- L. ANSI/AWWA C500 - Gate Valves, 3 through 48 in NPS, for Water and Sewage Systems.
- M. ANSI/AWWA C502 - Dry Barrel Fire Hydrants.
- N. ANSI/AWWA C504 - Rubber Seated Butterfly Valves.
- O. ANSI/AWWA C508 - Swing-Check Valves for Waterworks Service, 2 in through 24 in NPS.
- P. ANSI/AWWA C509 - Resilient Seated Gate Valves 3 in through 12 in NPS, for Water and Sewage Systems.  
  
AWWA C512 - Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service  
  
AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service  
  
AWWA C550 - Protective Epoxy Interior Coating for Valves and Hydrants
- Q. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances.  
  
AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water  
  
AWWA C651 - Disinfecting Water Mains
- R. ANSI/AWWA C606 - Grooved and Shouldered Type Joints.  
  
AWWA C800 - Underground Service Line Valves and Fittings

- S. ANSI/AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water.
- T. ASTM B88 - Seamless Copper Water Tube.  
  
Copper Development Association (CDA)  
  
Copper Tube Handbook International Conference of Building Officials (ICBO)
- U. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- V. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Plastic Pipe(SDR-PR).
- W. ASTM D2855 - Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
- X. ASTM D2922 - Test Methods for Density of Soil and Soil- Aggregate in Place by Nuclear Methods (Shallow Depth).
- Y. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
- Z. ASTM D3139 - Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
- AA. ASTM D3035 - Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.  
  
ASTM - D2774 Standard Practice for Underground Installation of Thermoplastic Pressure Piping  
  
ASTM F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- BB. AWWA C901 - Polyethylene (PE) Pressure Pipe, Tubing, and Fittings, 1/2 inch through 3 inch, for Water.
- CC. UL 246 - Hydrants for Fire - Protection Service.  
  
National Fire Protection Association (NFPA) 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances
- DD. Local Authority Water and Sewer Department standards and specifications. All materials and construction shall conform, at a minimum, to Local Authority Having Jurisdiction (LAHJ) standards and specifications. Contractor is responsible for verification of LAHJ specifications prior to construction.

When standards or specifications are indicated herein by reference, the referenced portion shall apply to the most recent edition of the publication and shall have the same force and effect as if they were included herein in their entirety.

#### 1.04 SUBMITTALS

- A. Provide data indicating pipe, pipe accessories, and manufacturer's warranties.
- B. Manufacturer's Installation Instructions: Indicate special procedures required to install products specified.
- C. Manufacturer's Certificate: Certify that products meet or exceed specifications and/or referenced standards.

#### 1.05 PROJECT RECORD DOCUMENTS

- A. Submit complete, detailed as built drawings to Owner, Developer, and Architect upon completion of the work showing vertical and horizontal location. As built drawings shall be based on field run survey(s) and be sealed and signed by a registered surveyor in the State where the project is located. Provide three sets of original hard copies and one digital file in AutoCad or other acceptable digital format. Contractor is responsible for approval and verification of acceptable digital format. **As-built drawings will be required at a minimum 45 days prior to substantial completion.**
- B. Accurately record actual locations of pipe runs, taps, connections, valves, tees, mechanical joints, connections, pipes, manholes, structures, sub-surface drain fields, septic tanks, lift stations, service taps or stubouts, type and size of material, and top and invert elevations of all structures.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities or other structures. All such uncharted utilities or structures shall be shown on as built drawings.

#### 1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with local utility company providing water service standards and specifications. Contractor shall coordinate with utility concerning inspection, testing and applicable specifications. The minimum requirements of the referenced standards herein shall be maintained in the event of conflicts with the local utility requirements.

- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Follow manufacturer's installation requirements and recommendations.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site in a timely manner to facilitate the construction schedule. Protect materials and equipment from damage due to construction, weather, or other means.
- B. Deliver and store valves in shipping containers with labeling in place.

#### 1.08 DESCRIPTION OF WORK

- A. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.

### PART 2 - PRODUCTS

#### 2.01 WATER PIPE

- A. Lines 4" and larger shall be ductile iron pipe (DIP). All pipes shall be permanently marked to allow identification of type and class and Underwriters Laboratories (UL) listed or Factory Mutual (FM) approved if used for fire protection and shall conform to the following material requirements:

Ductile Iron Pipe (DIP) 4" and larger shall be as noted on the drawings but not less than pressure class 350, conforming to AWWA C151, with rubber-gasket joints conforming to AWWA C111, and cement-mortar lining conforming to AWWA C104. The pipe exterior shall have a bituminous outside coating conforming to AWWA C151.

Flanged Ductile Iron Pipe shall conform to AWWA C115.

- B. Service Lines 3" and smaller shall conform to the applicable provisions of AWWA C800, and shall conform to the material requirements for the following piping materials:

Copper Tubing: Type K, hard drawn or annealed, conforming to ASTM B88. Joints shall be AWS A5.8, BCuP silver braze.

- C. All materials and construction shall conform, at a minimum, to Local Authority Having Jurisdiction (LAHJ) standards and specifications.

Contractor is responsible for verification of LAHJ specifications prior to construction.

2.02 GATE VALVES - Up to 3 Inches (75 mm):

- A. Shall conform to local authority standards and specifications.

2.03 GATE VALVES - 3 Inches (75 mm) and Over

- A. Shall conform to local authority standards and specifications.

2.04 BALL VALVES - Up to 2 Inches (50 mm)

- A. Shall conform to local authority standards and specifications.

2.05 SWING CHECK VALVES - From 2 inches to 24 inches (50 mm to 600 mm)

- A. Shall conform to local authority standards and specifications.

2.06 BUTTERFLY VALVES - From 2 inches to 24 inches (50 mm to 600 mm)

- A. Shall conform to local authority standards and specifications.

2.07 BEDDING MATERIALS

- A. Bedding: Fill materials must be approved by soils engineer prior to placement and compaction. Cut trenches sufficiently wide to enable installation and inspection. The minimum bedding for all pipes is Class B as shown on the plans unless specified otherwise.

2.08 REQUIRED ACCESSORIES

- A. Concrete Thrust Blocks: Shall conform to local authority standards and specifications at a minimum.
- B. Backflow Prevention (BFP), Fire Department Connection (FDC), Post Indicator Valve (PIV): Shall conform to local authority standards and specifications.
- C. Meter(s): Shall conform to local authority standards and specifications.
- D. Manhole and Cover: Shall conform to local authority standards and specifications.

PART 3 - EXECUTION



### 3.01 EXAMINATION

- A. Verify existing conditions, all existing utilities, verify and coordinate all existing and proposed service taps with Local authority standards and specifications. All existing service or water main taps or intersections shall be protected, maintained, and re-installed per Local Authority specifications when original taps or connections are relocated or moved to complete the proposed work.
- B. Verify that building service connection, vault, meter, and municipal utility water main size, location and invert are as indicated on the drawings.
- C. All construction which impacts fire lines or fire suppression system components in any way shall be done in strict accordance and with prior approval of the Fire Department having jurisdiction (FDHJ). Maintain fire protection service at all times as specified by the FDHJ.

### 3.02 PREPARATION

- A. Ream pipe and tube ends and remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

### 3.03 BEDDING

- A. Excavate pipe trench in accordance with Section 02200 (2.07) and Section 02700 (3.03) for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Place bedding material at trench bottom, level materials in continuous layers not exceeding 6 inches compacted depth. Minimum compaction for pipe trenches is 95% of standard proctor or as directed by the soils engineer.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.

### 3.04 INSTALLATION - PIPE

- A. Maintain separation of water main from other underground utilities, pipes, or obstructions of one foot minimum.

- B. Install pipe to indicated elevation to within tolerance of 5/8 inches. Maintain minimum depth of cover over top of pipe of 48 inches or as specified Local authority standards and specifications, whichever is greater.
- C. Install ductile iron piping and fittings to ANSI/AWWA C600.
- D. Route pipe in straight line.
- E. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- F. Install access fittings to permit disinfection of water system.
- G. Slope water pipe and position drain at low points.
- H. Form and place concrete for thrust blocks at each elbow or change of direction of pipe main and as specified by Local authority standards and specifications.
- I. Establish elevations of buried piping to ensure not less than 48 inches of cover over top of pipe.
- J. Install trace wire continuous over top of pipe.
- K. Backfill trench in accordance with Section 02200 (2.06).
- L. All materials and construction shall conform, at a minimum, to the manufacturer's standards and specifications.

### 3.05 INSTALLATION - VALVES

- A. Set valves on solid bearing.
- B. Center and plumb valve box over valve. Set box cover flush with finished grade.

### 3.06 DISINFECTION AND TESTING OF WATER PIPING SYSTEM

- A. Clean, pressure test, flush and disinfect system in accordance with local authority standards and specifications, all applicable AWWA standards, and reference standards herein (1.03) constituting minimum requirements. Provide documentation for all disinfection and testing procedures and results. All water lines must comply with 3.06 Disinfection and Testing of Water Piping System requirements.

### 3.07 SERVICE CONNECTIONS

- A. Provide water service tap per all utility authority requirements including

but not limited to reduced pressure device(s), backflow prevention devices, vaults, valves, post indicator valve, fire department connection(s), and water meter(s) with by-pass valves as required by Local authority standards and specifications.

### 3.08 FIELD QUALITY CONTROL

- A. Field inspection and testing of earthwork will be performed under provisions of Section 02200 (1.06).
- B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest, until the work meets specified requirements.
- C. Frequency of Tests: As directed by the soils engineer.

END OF SECTION 02713



## **SECTION 02730 - SANITARY SEWERAGE**

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Sanitary sewerage drainage piping, structures, fittings, accessories and bedding.
- B. Connection of building sanitary drainage system to existing municipal sewer system.

#### 1.02 RELATED DOCUMENTS/SECTIONS

- A. Contract documents and drawings, construction details as shown on the plans, geotechnical engineering report, and Referenced Standards are included herein by reference, latest revision shall apply. Refer to appropriate related sections as applicable.

#### 1.03 REFERENCED STANDARDS

- A. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.
- B. ANSI/ASTM A74 - Cast Iron Soil Pipe and Fittings.
- C. ANSI/ASTM C12 - Practice for Installing Vitrified Clay Pipe Lines.
- D. ANSI/ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.
- E. ANSI/ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- F. ANSI/ASTM C425 - Compression Joints for Vitrified Clay Pipe And Fittings.
- G. ANSI/ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- H. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- I. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of

Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

- J. ANSI/ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
- K. ANSI/ASTM D2729 - Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- L. ANSI/ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- M. ANSI/ASTM D3033 - Type PSP Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- N. ANSI/ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- O. ASTM A746 - Ductile Iron Gravity Sewer Pipe.
- P. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- Q. ASTM C700 - Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.
- R. ASTM D1785 - Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.
- S. ASTM D2922 - Test Methods for Density of Soil and Soil- Aggregate in Place by Nuclear Methods (Shallow Depth).
- T. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
- U. Shall conform to Local authority standards and specifications.
- V. ASTM C478 - Specification for Precast Reinforced Concrete Manhole Sections

When standards or specifications are indicated herein by reference, the referenced portion shall apply to the most recent edition of the publication and shall have the same force and effect as if they were included herein in their entirety.

#### 1.04 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations. Cut trenches sufficiently wide to enable installation and inspection. The minimum bedding for all pipes is Class B as shown on the plans unless specified otherwise.

#### 1.05 SUBMITTALS

- A. Provide data indicating pipe, pipe accessories, and manufacturer's warranties.
- B. Manufacturer's Installation Instructions: Indicate special procedures required to install products specified.
- C. Manufacturer's Certificate: Certify that products meet or exceed specifications and/or referenced standards.

#### 1.06 PROJECT RECORD DOCUMENTS

- A. Submit complete, detailed as built drawings to Owner, Developer, and Architect upon completion of the work showing vertical and horizontal location. As built drawings shall be based on field run survey(s) and be sealed and signed by a registered surveyor in the State where the project is located. Provide three sets of original hard copies and one digital file in AutoCad or other acceptable digital format. Contractor is responsible for approval and verification of acceptable digital format. **As-built drawings will be required at a minimum 45 days prior to substantial completion.**
- B. Accurately record actual locations of pipe runs, taps, connections, valves, tees, mechanical joints, connections, pipes, manholes, structures, sub-surface drain fields, septic tanks, lift stations, service taps or stubouts, type and size of material, and top and invert elevations of all structures.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities or other structures. All such uncharted utilities or structures shall be shown on as built drawings.

#### 1.07 REGULATORY REQUIREMENTS

- A. Conform to all applicable Federal, State, County, City, or local jurisdiction requirements concerning sanitary sewer construction and

safety.

- B. **WARNING:**  
**CONTRACTOR SHALL: COMPLY WITH ALL OSHA, FEDERAL, STATE, LOCAL, AND INDUSTRY STANDARD SAFETY MEASURES, DEVICES, PROCEDURES, PRECAUTIONS, AND EQUIPMENT FOR ALL WORK OR OTHER ACTIVITIE(S). NO PERSON(S) SHALL ENTER MANHOLES, CONFINED SPACES, OR OTHER UNDERGROUND STRUCTURES, SPACES, TRENCHES, OR EXCAVATIONS WITHOUT PROTECTIVE BREATHING APPARATUS AND ALL OTHER REQUIRED SAFETY MEASURES, DEVICES, PROCEDURES, AND EQUIPMENT, AND AT LEAST ONE OTHER PERSON PRESENT ABOVE GROUND FOR SAFETY AND MONITORING AT ALL TIMES. CONTRACTOR SHALL PROVIDE AND ENSURE USE OF SAFETY KITS, HELMETS, GLOVES, EMERGENCY OXYGEN RESUSCITAOR KITS, AND AIR QUALITY AND GAS DETECTORS FOR VOLATILE, TOXIC, OR EXPLOSIVE GASES OR SUBSTANCES. VERIFY SAFE OXYGEN CONTENT PRIOR TO ENTERING MANHOLES, CONFINED SPACES, OR OTHER UNDERGROUND STRUCTURES.**

#### 1.08 FIELD MEASUREMENTS

- A. Verify that field measurements and elevations are as indicated by the manufacturer.

#### 1.09 COORDINATION

- A. Coordinate work with other underground utilities, both existing and proposed. Verify all existing utilities concerning type, size, location and depth prior to start of construction.
- B. Coordinate the Work with termination of sanitary sewer connection outside building.

#### 1.10 DESCRIPTION OF WORK

- A. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.

### PART 2 - PRODUCTS



## 2.01 SANITARY SEWER PIPE MATERIALS

- A. All sanitary sewer structures, piping, materials and installation shall conform to the local authorities having jurisdiction standards and specifications. In the absence of local authority standards and specifications, all materials and construction shall conform, at a minimum, to the current Georgia Department of Transportation (GDOT) standards and specifications, and as specified herein, whichever is greater. The Contractor is responsible for verification of current applicable standards and specifications prior to construction.
- B. Ductile Iron Pipe: Shall conform to Local authority standards and specifications.
- C. Ductile Iron Pipe Joint Device: Shall conform to Local authority standards and specifications.
- D. Plastic Pipe: Shall conform to Local authority standards and specifications.
- E. PVC Pipe: Shall conform to Local authority standards and specifications, minimum SDR 35.

## 2.02 PIPE ACCESSORIES

- A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.
- B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.
- C. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Sewer Service" in large letters shall be placed for underground piping.
- D. All pipe joints shall provide a permanent, secure watertight seal.

## 2.03 BEDDING MATERIALS

- A. Bedding: Fill materials must be approved by Soils Engineer prior to placement and compaction.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Verify all existing utility structures regarding location and elevation prior to construction. Verify that trench is graded and prepared according to plans and specifications prior to pipeline construction.

### 3.02 PREPARATION

- A. Hand trim excavations to required elevations. Correct over-excavation with fine aggregate or as directed by the soils engineer. Verify all fill material as suitable with the soils engineer prior to placement and compaction.
- B. Remove large stones, debris, rock, roots, organic material, or other hard matter which could damage piping or impede consistent backfilling or compaction.

### 3.03 BEDDING

- A. Excavate pipe trench in accordance with Section 02200 for work of this section. Hand trim excavation for accurate placement of pipe to elevations indicated. Cut trenches sufficiently wide to enable installation and inspection. The minimum bedding for all pipes is Class B as shown on the plans unless specified otherwise.
- B. Place bedding material at trench bottom, level materials in continuous layers not exceeding 6 inches compacted depth. Minimum compaction for pipe trenches is 95% of standard proctor or as directed by the soils engineer.
- C. Maintain optimum moisture content of bedding material to attain required compaction.

### 3.04 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. All joints shall be permanent, secure, and watertight.
- B. Lay pipe to slope gradients noted on drawings, with maximum variation from true slope of 1/8 inch in 10 feet, non cumulative.

- C. Install pipe bedding aggregate at bottom, sides and over top of pipe where required and as shown on the drawings. Provide top cover to minimum compacted thickness of 12 inches, compact to minimum 95% standard proctor.
- D. Refer to Section 02200 for trenching requirements. Do not displace or damage pipe when compacting.
- E. Refer to Section 02200 for field testing requirements for fill materials.
- F. Install tracer wire on all pipe runs, drain field tiles, and underground piping.

### 3.05 INSTALLATION – MANHOLES, JUNCTIONS, STRUCTURES

- A. All manholes, junctions, or structures shall be precast reinforced concrete, with paved invert channels per current GDOT standards and specifications. All grout shall be nonmetallic, non-shrink type conforming to ASTM C 1107, with minimum 28 day compressive strength of 6500 psi. Set all manholes plumb. Install per manufacturer's specifications.
- B. Manhole, junction, or structure riser sections shall be watertight and sealed per manufacturer's specifications and reference standards using preformed resilient gaskets. Joints between manholes or structures and base sections shall be grouted on the inside to provide a smooth surface. Manhole sections shall grouted to ring and covers on the inside. Comply fully with ASTM C478.
- C. All pipe or other penetrations into manholes, structures, or junctions shall be sealed watertight. Provide resilient connectors manufactured for use in contact with sanitary sewer conforming to ASTM C923 and the local authority having jurisdiction specifications. All penetrations shall be fully sealed, permanent, and watertight.

### 3.06 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 02200.
- B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest, until the work meets specified

requirements.

- C. Frequency of Tests: As directed by the soils engineer.

### 3.07 PROTECTION

- A. Protect finished Work from damage during construction. Damaged work shall be replaced at the expense of the contractor.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 02730

## **SECTION 02831 - FENCING**

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Fencing, fittings, accessories.

#### 1.02 RELATED DOCUMENTS/SECTIONS

- A. Contract documents and drawings, construction details as shown on the plans, geotechnical engineering report. Refer to appropriate related sections as applicable.

#### 1.03 FENCING

- A. All materials and construction shall conform to the Chain Link Fencing Manufacturers Institute (CLFMI) standards and specifications and the local authority having jurisdiction, and the plans and specifications. Provide all materials and accessories from a single source.

- B. TEMPORARY CONSTRUCTION FENCING: Contractor shall provide temporary fencing as required for safety of all person(s) onsite for all phases of construction.

Temporary fence characteristics: Minimum 6 feet overall exposed height, minimum 12-1/2 gauge hog wire (no barbed wire) tied at 12 inches on center, with drive-in metal posts securely anchored, minimum driven post depth is 18 inches, or deeper as required for stability. Maximum post spacing is 8.0 feet. Provide concrete footings where necessary to stabilize fencing. Contractor to increase minimum fence criteria as required, per Code(s), and to suit his other needs for security and safety.

Gates required: As necessary, with padlocks. Provide warning and no access signage at 10 foot intervals along all temporary fencing.

#### TEMPORARY CONSTRUCTION FENCING LOCATIONS:

Temporary construction fencing locations shall be including but not limited to: around all construction work areas, along entire top edge perimeter of all shoring or sheet piling walls, storage areas, and construction staging/parking areas. At additions or renovations to existing buildings, all area(s) necessary to provide all person(s) safe access to all areas in use or required by Owner. Adjust temporary fencing location(s) and gate(s) as required for each phase of construction to provide protection and safety for all person(s) onsite and for all areas, functions, or uses as required by Owner.

Provide safe access or pathways including but not limited to sidewalks, steps, and railing per standard details and Code(s) where designated by Owner/Engineer, with directional and warning signage for all pedestrian traffic.

Coordinate with Owner all required access and use areas prior to and throughout construction for each phase or required use.

#### 1.04 DESCRIPTION OF WORK

- A. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.

### PART 2 - PRODUCTS

#### 2.01 GENERAL

- A. All materials and construction shall conform to the Chain Link Fencing Manufacturers Institute (CLFMI) standards and specifications. Provide all materials and accessories from a single source. All fencing material shall be vinyl coated unless noted otherwise. Verify color with Architect/Owner prior to construction.
- B. Fabric: 2-inch diamond mesh. Minimum 9 gauge galvanized steel wire. Knuckle selvage top and bottom.
- C. Terminal and Gate Posts: 3-inch o.d., hot-dipped galvanized, schedule 40 steel pipe. Lengths = Exposure + 36" for embedment.
- D. Line Posts: 2-inch o.d., hot-dipped galvanized, schedule 40 steel pipe. Lengths = Exposure + 30" for embedment.
- E. Post Caps: Required for all posts. Size to suit posts, integral eye for passage of top rail or tension wire.
- F. Top Rails: 1-5/8 inch o.d., hot-dipped galvanized, schedule 40 steel pipe. Fabricate for swedge-type joints.
- G. Braces: Material same as rails.
- H. Fabric Tension Bars: 3/16" x 3/4" hot-dipped galvanized, single piece full height of fabric. Bands shall be 11 gauge x 7/8" wide.

- I. Tension Wire: 7 gauge coated steel coil spring wire. Required at bottom of all fencing.
- J. Fabric Ties: 11 gauge aluminum alloy.
- K. Gates:
  - Framework and diagonal bracing: Same as top rail pipe, shop fabricated welded construction, all welds ground smooth, hot-dipped galvanized.
  - Hinges: Offset non-liftoff type to achieve 180-degree opening, minimum 1 for each 24" of gate height or fraction thereof.
  - Latch: Fork type or plunger bar type with integral padlock eye to permit operation and unlocking from either side of gate.
  - Keeper: 1 for each leaf, automatically engages gate leaf and holds leaf open until manually released.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Layout fencing per Contract drawings and/or actual site conditions. Temporary construction fencing shall be provided as required to protect all persons from work/construction areas, provide for the safety of the public, and provide safe access for Owner as necessary for normal operation.
- B. Set all posts plumb. All permanent fencing posts shall be set in center of 3000 psi concrete footings in firm solid earth. Terminal and gate posts set in 12" diameter x 42" depth footings, line posts set in 10" diameter x 36" depth footings. Post lengths to achieve minimum 6" concrete coverage under post bottom and sides, posts shall not contact earth. Top of concrete finished smooth, set to finished grade, and sloped away from post to shed water. Exposed post height to achieve fabric height plus 2 inches of fabric clearance above finished grade.
- C. Locate terminal posts at all corners and changes of direction. Install braces at each terminal post with pressed steel connectors.
- D. Locate gate posts at both gate jambs of each gate. Install braces at each gate post with pressed steel connectors. Line posts evenly spaced at maximum 10.0 feet on center.
- E. Tie fabric to posts at 15" o.c. maximum, tie fabric to top rails at 24" o.c. maximum.
- F. Top rails shall be installed parallel to finish grade.
- G. Adjust gates and gate hardware for smooth operation without binding or scraping.
- H. Remove temporary construction fencing at completion of project.

### 3.02 PROTECTION

- A. Protect finished Work from damage during construction. Damaged work shall be replaced at the expense of the contractor.

END OF SECTION 02831



## **SECTION 02900 - LAWNS, GRASSING, & LANDSCAPING**

### PART 1 - GENERAL

#### 1.01 PERMANENT GRASSING REQUIREMENTS:

**THE CONTRACTOR SHALL ESTABLISH PERMANENT GRASSING ON ALL DISTURBED AREAS PRIOR TO FINAL RELEASE WHETHER SHOWN ON THE PLANS OR NOT.**

#### 1.02 SECTION INCLUDES

- A. Lawns, grassing, and landscaping materials and planting instructions.

#### 1.03 RELATED DOCUMENTS/SECTIONS

- A. Contract documents and drawings, construction details as shown on the plans, geotechnical engineering report. Refer to appropriate related sections as applicable.

#### 1.04 WARRANTIES

- A. Warranty commencement date will be date of final approval and release after all grassing and landscaping is complete, established and accepted by Owner or Architect.
- B. Materials:
  - 1. Sod and grasses:  
One year following Owner acceptance.
  - 2. Evergreen shrubs, bushes, & trees:  
One year following Owner acceptance.
  - 3. Deciduous Plants and trees:  
90 days following Spring breakout of growth.
- C. Replacement policies:
  - 1. Materials which have either died or failed to show satisfactory vigorous growth shall be removed and replaced with equal as-specified materials.
  - 2. Warranty periods for replaced materials shall commence on the Owner-acceptance dates for these materials, and warranty criteria shall be the same as outlined above.
  - 3. If replaced materials become unsatisfactory within their new warranty periods, the Owner reserves the right to require continued replacements

or obtain a credit from the Contractor for the value of the unsatisfactory materials.

#### 1.05 REFERENCED STANDARDS

- A. Standardized Plant Names, latest edition, by the American Joint Committee on Horticultural Nomenclature.
- B. American Standard for Nursery Stock, latest edition, by the American Association of Nurserymen.

When standards or specifications are indicated herein by reference, the referenced portion shall apply to the most recent edition of the publication and shall have the same force and effect as if they were included herein in their entirety.

#### 1.06 QUALITY CONTROL

- A. Only tree or plant material grown in a recognized nursery in accordance with good horticultural practice will be accepted. Provide healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun-scald, injuries, abrasions or disfigurement.
- B. All materials and construction required for completion of the work under this section are subject to the approval of the Owner/Architect. The Owner/Architect shall have the right to reject any and all materials and construction which, in their own opinion, does not meet the requirements of the Contract Documents. The Contractor shall remove all rejected work or material from the job site and replace promptly according to the Contract Documents at no expense to the Owner.

#### 1.07 DESCRIPTION OF WORK

- A. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.

### PART 2 - PRODUCTS

#### 2.01 GENERAL

- A. PERMANENT GRASSING: (Sodded, seeded, or sprigged):  
**VERIFY AREAS TO BE SODDED WITH OWNER PRIOR TO**

## **CONSTRUCTION.**

Seed: Common Bermuda (Cynodon dactylon), 98% purity, 85% germination, with State Dept. of Agriculture tag, or as specified by Owner.

Sod and sprigs: Hybrid Bermuda, Tifway 419, or as specified by Owner.

**B. TEMPORARY GRASSING:**

As shown on plans, or Kentucky 31 Fescue and/or winter rye, allowed for Contractor's convenience to control erosion or other purposes. Temporary grass must be tilled under and soil prepared for permanent grassing per specifications.

**C. LANDSCAPING MATERIALS:**

Plants: True to species and variety, complying to ANSI Z60.1 "Standard for Nursery Stock".

Trees: Of height and caliper listed with branching configuration conforming to ANSI Z60.1 for type and species required. Provide only single stem trees.

Ground cover: Provide plants well established and well rooted in removable containers with not less than the minimum number and length of runners conforming to ANSI Z60.1 for the pot or container size listed.

**D. FERTILIZER:**

Commercial slow release type, 5% nitrogen, 10% phosphoric acid, 15% potash.

**E. LIME:** Ground dolomitic limestone.

**F. WATER:**

Contractor shall furnish all water as required for establishment and maintenance of all grassing (sod or seed), trees, shrubs, plants, and other landscape materials until final approval and acceptance by Owner and Architect. Contractor is responsible for water source, transportation, distribution, and necessary equipment.

**G. MULCH:**

Pine bark mini-nuggets or shredded hardwood mulch (color per Architect).

## **PART 3 - EXECUTION**

### **3.01 GENERAL**

- A. Contractor is solely and fully responsible for compliance with recommended and seasonal planting dates for all seeding, grassing, sod, trees and shrubs, and all other landscape materials to facilitate construction schedule and stabilize disturbed areas. Any planting or installation of any landscaping or grassing materials outside recommended planting dates will require additional warranties and delay final release and payment for all affected material and labor cost(s). Contractor shall review all drawings and specifications, and locate and protect from damage any and all existing or proposed utilities or site improvements prior to landscape excavation or work. Contractor shall restore any damaged improvements or utilities at no expense to Owner.
- B. SOIL SAMPLES: Contractor shall take several soil samples from each area where landscaping will occur. Samples shall be taken to represent each different soil or site condition encountered in the required landscaping areas. Soil samples shall be sent for analysis to the Agricultural Extension Service (AES). Provide the A/E with the written report of AES recommendations for soil amendments and fertilizers to be used on the site. All recommendations from the AES will become minimum requirements. No adjustment in Contract Time or Contract Sum will be allowed for soil sampling and analysis.
- C. TOP SOIL: Provide topsoil which is fertile, friable, natural loam surface soil, free of subsoil, clay lumps, brush, weeds and other debris, free of roots, stumps, stones larger than 1/2" diameter in any dimension, and any other extraneous or toxic material or debris harmful to plant growth. The Contractor is solely responsible for obtaining and distributing all required topsoil material for grassing, planting, and landscaping the project, regardless of the source. Minimum 5 inch depth of topsoil required for all grassed areas, minimum 9 inch depth of topsoil required for shrubbery, flower, or planting beds or areas.
- D. FINISH GRADE REQUIREMENTS:
  - a. Within 0.10 feet of required grade provided positive drainage is maintained. No ponding or depressed areas allowed.
  - b. Smooth and uniform to accomplish mowing of grass to uniform heights without scalping. Remove all stones 1/2" and larger in diameter prior to grassing operations.
  - c. Sloped at minimum 1.0% grade for proper drainage away from buildings and into storm sewer system.
  - d. Sod shall be set in place with snug and staggered joints, and rolled to remove high or low or undulating areas.

**e. Contractor shall coordinate all landscaping to ensure that finished grades are provided as shown on plans, particularly along the interface with the building perimeter to ensure positive drainage away from building(s), structures, and all other improvements which may be damaged by water or runoff. Maintain minimum 6 inches below finish floor elevation (FFE) and top of finished grass, landscape, or mulch along entire building or structure perimeter. Verify FFE along entire building or structure perimeter PRIOR TO CONSTRUCTION. Adjust subgrade, topsoil, and mulch as required to allow for grass and landscape material thickness.**

**E. PERMANENT GRASSING:**

The Contractor is responsible for establishing final permanent grassing on all disturbed areas in accordance with the Contract Documents whether shown on the plans or not. All temporary grassing which does not comply with the required permanent grassing materials and were installed for erosion control measures or the convenience of the Contractor, shall be fully tilled under, then the soil shall be prepared for permanent grassing in accordance with Contract Documents.

**F. ACCEPTABLE UNIFORM STAND OF GRASS:**

An acceptable uniform stand of grass is defined as:

**Establishment of the specified grass, properly watered, maintained, mowed, and free of weeds, with the grass having a minimum coverage of 97% over the required areas and only scattered bare spots, none of which is larger than one (1) square foot in area. Coverage is defined as mature healthy grass with established root systems, thickness and density per normal species nursery standards for grass in good condition.**

**G. MOWING SCHEDULE:**

A. All grass clippings shall be removed from property with EACH mowing.

B. When grass reaches a height of three (3) inches, mow to 2/3 height, leaving two (2) inches remaining.

C. Maintain a grass height between two (2) and two and one-half (2.5) inches until final acceptance.

D. Perform mowing approximately weekly, or as required to fulfill the criteria in this section, for a total of not less than four (4) mowings prior to final acceptance and release. Establish grass in timely manner to meet this requirement prior to final release and acceptance.

**H. GRASS MAINTENANCE & ACCEPTANCE:**

Contractor shall maintain grass until final release and acceptance but for not less than 60 calendar days after seeding/sodding or planting. Maintenance shall include watering per nursery/supplier standards, additional watering for initial period after planting per accepted nursery standards, and all other recommended measures to ensure root system establishment and healthy grass. Full grass coverage shall be required within 60 calendar days of planting. The Contractor is responsible for establishment of permanent grassing and landscaping, including mowing, watering, and maintenance requirements, prior to final release and acceptance.

I. TREE, SHRUB, LANDSCAPING MAINTENANCE & ACCEPTANCE:

Contractor shall install, establish, and maintain trees, shrubs, and landscaping until final release and acceptance but for not less than 60 calendar days after proper installation. Maintenance shall include watering per nursery/supplier standards, additional watering as required for initial period after planting per accepted nursery standards, and all other recommended measures to ensure root system establishment and healthy trees, shrubs, and landscape materials. The Contractor is responsible for installation of trees, shrubs, and landscaping including watering, mulching, and maintenance requirements, prior to final release and acceptance.

### 3.02 EXCAVATION & PREPARATION

A. TREES, SHRUBS, & OTHER PLANTED MATERIALS:

1. Excavate pits, beds, or trenches with vertical sides.
2. Loosen hardpan and moisture barrier to a depth of 2 feet minimum below bottom of tree pit or until hardpan has been broken and moisture drains freely. For shrub beds, loosen hardpan 6 inches minimum below bottom of excavation.
3. For balled & burlapped (B&B) trees and shrubs, make excavations at least 50% larger width than the ball diameter and equal to the ball depth, plus allowing for 6 inch minimum setting layer of planting soil mixture.
4. Mix all soil amendments thoroughly into topsoil as required by soil analysis and manufacturers recommendations prior to backfilling.
5. Plant trees and shrubs according to nursery specifications.
6. Provide minimum 3 inch depth mulch to cover all disturbed areas for tree planting and planting beds for shrubs, plants, or flowers. Verify with

Owner/Architect extent of all areas to receive mulch prior to construction.

**7. The Contractor shall provide a professional landscape contractor with minimum two years experience in landscaping and tree, shrub, planted material installation. Landscape contractor must be engaged in landscaping full time as majority of his business. Landscaping contractor shall be submitted to and approved by Owner/Architect prior to start of landscaping work. Landscape contractor shall provide a minimum 12 month warranty for all lawns/grass/landscaping installed.**

**B. TREE & SHRUB RELOCATION:**

1. Contractor shall engage and provide a qualified arborist for review and recommendation regarding all trees and shrubs to be transplanted or relocated. Arborist shall be qualified according to standards referenced herein, and recognized industry standards for this work.
2. Contractor shall review requirements of Arborist with Owner/Architect regarding cost and chance for survival prior to proceeding with the work.
3. All materials and construction shall be in accordance with Arborist's recommendations and specifications.
4. Contractor shall provide a qualified subcontractor to complete this work (see 3.02 A (6) above) with experience and qualifications acceptable to Owner/Architect.
5. Provide minimum 3 inch depth mulch to cover all disturbed areas for tree planting and planting beds for shrubs, plants, or flowers. Verify with Owner/Architect extent of all areas to receive mulch prior to construction.

**C. PLANTING BEDS:**

1. Loosen subgrade of planting bed areas to minimum 6 inch depth. Remove stones larger than 1" diameter, sticks, roots, or other debris.
2. Mix all soil amendments thoroughly into topsoil as required by soil analysis and manufacturers recommendations prior to backfilling.
3. Spread planting soil mixture to minimum depth to meet proposed grades, allow for natural settlement. Work into top of loosened subgrade to create transition layer, then place remainder of planting soil.
4. Plant according to nursery specifications.

5. Provide minimum 3 inch depth mulch to cover all disturbed areas for tree planting and planting beds for shrubs, plants, or flowers. Verify with Owner/Architect extent of all areas to receive mulch prior to construction.

D. GRASS AREAS:

1. Loosen subgrade of areas to be grassed to a minimum 6 inch depth. Remove stones larger than 1" diameter, sticks, roots, trash, or other debris.

2. Place 50% of required topsoil, work into loosened subgrade to create transition layer. Place remaining topsoil to meet proposed grades.

3. Allow for sod thickness in areas to be sodded to meet finish grades.

4. Grade areas to be grassed to smooth, even surface, with loose, uniformly fine texture. Roll, rake, and remove ridges and depressions to meet finish grades.

5. Apply all fertilizer, lime, and soil amendments required for grass type selected according to the soils sample analysis prior to installing grass. Work into top 6 inches of soil.

6. Moisten prepared grass areas if soil is dry. Water thoroughly and allow surface to dry before planting grass.

### 3.03 INSTALLING LAWNS AND GRASSING

A. SEEDING GRASSED AREAS:

1. Do not use wet seed. Day laborers or other unskilled workers shall not be used for lawn and grass installation. All grass areas shall be prepared in accordance with section 3.02 (D).

**The Contractor shall provide a professional landscape contractor with minimum two years experience in landscaping and lawn/grass installation. Landscape contractor must be engaged in landscaping full time as majority of his business. Landscaping contractor shall be submitted to and approved by Owner/Architect prior to start of landscaping work. Landscape contractor shall provide a minimum 12 month warranty for all lawns/grass/landscaping installed.**

2. Sow seed using a spreader or seeding machines. Grass seed shall be applied at a rate according to nursery specifications, not less than 40



pounds per acre. Do not seed when wind velocity exceeds 5 mph. Distribute seed evenly over entire area by sowing equal quantity in two directions at right angles to each other.

3. When Hydro-seeding, soil preparation and all other requirements of the Contract Documents and specifications must be fully implemented.

4. Rake seed lightly into top 1/8" of soil, roll lightly.

5. Water immediately after seeding with a fine spray, soaking to a minimum depth of four (4) inches. Keep grassed areas continuously moist until grass is established.

6. Protect seeded areas with mulch to a depth not less than 1.5 inches immediately after seeding is complete. Mulch material and application shall comply, at a minimum, with erosion control specifications.

7. Protect seeded areas from traffic or damage.

8. Scarify, re-seed and re-fertilize seeded areas that do not show satisfactory growth within fifteen days after sowing, until satisfactory stand of grass is established.

B. SODDING GRASSED AREAS:

1. Do not use day laborers or unskilled workers.

**The Contractor shall provide a professional landscape contractor with minimum two years experience in landscaping and lawn/grass/sod installation. Landscape contractor must be engaged in landscaping full time as majority of his business. Landscaping contractor shall be submitted to and approved by Owner/Architect prior to start of landscaping work. Landscape contractor shall provide a minimum 12 month warranty for all lawns/grass/landscaping installed.**

2. Install sod within 36 hours of harvesting. Lay sod with tight joints, overlaps or gaps will not be allowed. Stagger sod joints, lay sod with long edge perpendicular to slope. Trim sod with sharp bladed instrument for clean cut, jagged edges not allowed. All sod areas shall be prepared in accordance with section 3.02 (D).

3. On slopes steeper than 3H:1V, sod shall be anchored with pins or other approved methods.

4. Installed sod shall be rolled and tamped to provide solid contact between sod and soil.

5. Irrigate sod and soil to a depth of 6 inches immediately after installation. Irrigate sod daily after installation to maintain moisture at 6 inch depth for a minimum 30 days, and as needed thereafter for health and maintenance of grass.

6. Sod shall be certified by supplier as meeting all requirements of plans and specifications, and for grass type selected.
7. Sod delivery, storage, and installation shall conform to Turfgrass Producers International (1995) Guideline Specifications to turfgrass sodding (TPI GSS).
8. Comply with supplier's standards and recommendations for sod delivery, storage, and installation. Do not install sod on frozen or freezing soil.
9. Protect sodded areas from traffic or damage.

END OF SECTION 02900

**SECTION 02990 – SOIL INVESTIGATION**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE OF WORK

- A. The following Geotechnical Study is included as prepared by Geo-Hydro Engineers..
- B. The report is included for Contractor's convenience. The Owner and Architect assume no responsibility for the accuracy or completeness nor for any conclusions which may be drawn from the investigation.
- C. The Contractor shall follow the recommendations made unless specifically noted otherwise on the drawings.

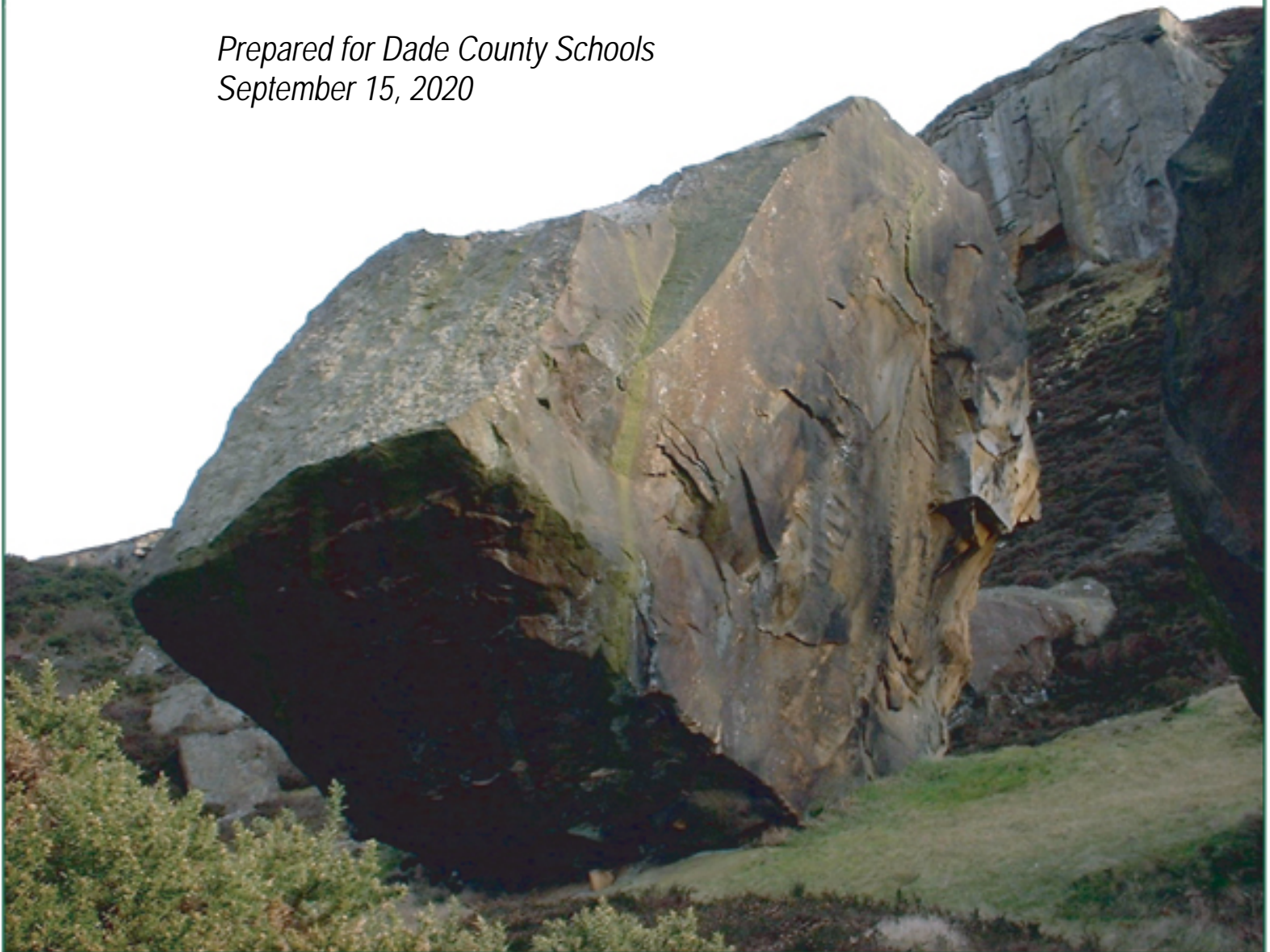
END OF SECTION 02990 (see attached)



Report of Subsurface Exploration  
and Geotechnical Engineered Evaluation

Davis Elementary School Addition  
5491 Highway 301  
Trenton, Georgia  
Geo-Hydro Project Number 200734.20

*Prepared for Dade County Schools  
September 15, 2020*



Mr. Josh Ingle  
Director of Federal Programs  
Dade County Schools  
Trenton, Georgia 30752  
c/o Mr. Kenneth Harless, AIA  
KRH Architects, Inc.

September 15, 2020

Report of Subsurface Exploration  
and Geotechnical Engineering Evaluation  
Davis Elementary School Addition  
5491 Highway 301  
Trenton, Georgia  
Geo-Hydro Project Number 200734.20

Dear Mr. Ingle:

Geo-Hydro Engineers, Inc. has completed the authorized subsurface exploration for the above referenced project. The scope of services for this project was outlined in our proposal number 24868.2 dated August 14, 2020.

PROJECT INFORMATION

Davis Elementary School is located at 5491 Highway 301 in Trenton, Georgia. Figure 1 in the Appendix shows the approximate site location.

The proposed construction consists of an expansion to the existing Davis Elementary School Campus. At the time of this report, we have not been provided a site plan showing the proposed addition. However, a portion of the campus has been recently demolished, and we understand that conditions encountered during demolition have raised concerns about shallow rock and difficult excavation conditions in the area.

Based on our conversations on site with you, we understand that the building addition will be a one- to two-story structure occupying the same general area as the recently demolished building. We expect the new building to have a structural steel frame with a brick veneer or glass curtain wall. We have assumed that the maximum column load will be no greater than 200 kips and maximum wall loads will not exceed 4 kips per lineal foot.

At the time of our exploration, the construction area was generally grassed. A shear face of apparent rock was visible in the area, and an existing well was discovered beneath the demolished building. We expect site grading to involve up to 5 feet of structural fill placement and 12 feet of mass excavation if the addition includes a basement level.



## EXPLORATORY PROCEDURES

The subsurface exploration consisted of 12 soil test borings performed at the approximate locations shown on Figure 2 included in the Appendix. The test borings were located in the field by Geo-Hydro using a handheld GPS unit with preloaded coordinates. In general, the boring locations should be considered approximate.

Standard penetration testing, as provided for in ASTM D1586, was performed at select depth intervals in the machine-drilled soil test borings. Soil samples obtained from the drilling operation were examined and classified in general accordance with ASTM D2488 (Visual-Manual Procedure for Description of Soils). Soil classifications include the use of the Unified Soil Classification System described in ASTM D2487 (Classification of Soils for Engineering Purposes). The soil classifications also include our evaluation of the geologic origin of the soils. Evaluations of geologic origin are based on our experience and interpretation and may be subject to some degree of variation.

Descriptions of the soils encountered, groundwater conditions, standard penetration resistances, and other pertinent information are provided in the test boring records included in the Appendix.

## REGIONAL GEOLOGY

The project site is located in the Appalachian Valley and Ridge Province of Georgia. Based on review of geologic maps, it appears that the site is underlain by a geologic unit known as the Lookout or Suwanee Sandstone.

The soils which form from the weathering of the parent rock are termed residual soils. The residual soils derived from limestone or shale are frequently clayey and may be highly plastic. The residual soils typically contain fragments of insoluble rock such as chert.

Solution activity within limestone and dolomite units occurs in the Valley and Ridge Province, particularly along joints, faults, and the bedding planes of the rock. Solution activity in areas where limestone and dolomite units are present directly under the overburden soils often results in the development of an extremely irregular rock surface that frequently has deep slots. The transition from soil to hard rock is generally rather abrupt, with the soils encountered immediately above the rock frequently having a much lower consistency than near the ground surface.

Solution activity can result in the formation of caverns within the limestone or dolomite, and the development of sinkholes and cavities within the overburden soils. Even in areas where deeper limestone or dolomite formations are overlain by shale or sandstones, a rock cavity collapse can occur within the upper rock unit.

Depending upon the stage of development of sinkholes, evidence of ground subsidence may be readily observable at the ground surface, or essentially no indication of impending sinkhole development may be present at the ground surface. The size and frequency of subsurface voids is highly variable and depends on several factors related to geology, climate, and man-induced conditions. The stability of subsurface



voids is related not only to the structural characteristics of the subsurface void; but also to proposed site grading, the magnitude of structural loads, significant changes in groundwater levels, drought, and any number of other factors. No obvious signs of sinkhole formation were observed during our work on site.

Stream valleys and areas adjacent to rivers and streams may contain alluvial (water-deposited) soils, depending on ground surface topography, stream flow characteristics, and other factors. By nature, alluvial soils can be highly variable depending upon the energy regime at the time of deposition. Coarse materials such as sand or gravel are deposited in higher energy environments, while fine grained materials such as silt and clay are deposited in low energy environments. Alluvial soils may also contain significant organic materials, and are frequently encountered in a loose, saturated condition. In many cases, fine-grained alluvial soils will be highly compressible and have relatively low shear strength.

### SOIL TEST BORING SUMMARY

Starting at the ground surface, all of the borings encountered an initial layer of topsoil ranging in thickness from about 2 to 3 inches. Detailed measurements necessary for quantity estimation were not performed for this exploration. For planning purposes, we recommend assuming an arbitrary surface material thickness of 6 inches.

Beneath the surface materials, boring D-7 encountered fill materials extending to a depth of about 3 feet. The fill was classified as fine sand with silt, with a standard penetration resistance of 9 blows per foot recorded in the fill.

Beneath surface materials or fill materials, all of the borings encountered residual partially weathered rock. Partially weathered rock is locally defined as residual material with a standard penetration resistance of 100 blows per foot or greater.

All of the borings encountered conditions causing auger refusal at depths ranging from 1 to 6 feet. Auger refusal is the condition that prevents further advancement of the boring using conventional soil drilling techniques. Auger refusal may be indicative of a boulder, a lens or layer of rock, a rock pinnacle, or a larger rock mass.

At the time of drilling, groundwater was not encountered in the borings. The borings were backfilled with soil cuttings upon completion. It should be noted that groundwater levels will fluctuate depending on yearly and seasonal rainfall variations and other factors and may rise in the future.

For more detailed descriptions of subsurface soil conditions, please refer to the test boring records included in the Appendix.

### Summary of Subsurface Conditions

Boring	Bottom of Fill (feet)	Depth to PWR (feet)	Depth to Auger Refusal (feet)	Boring Termination Depth (feet)	Depth to Groundwater (feet)
D-1	NE	0	1	1	NE
D-2	NE	0	4	4	NE
D-3	NE	0	3	3	NE
D-4	NE	0	3	3	NE
D-5	NE	0	4	4	NE
D-6	NE	0	1	1	NE
D-7	3	3	6	6	NE
D-8	NE	0	1	1	NE
D-9	NE	0	3	3	NE
D-10	NE	0	2	2	NE
D-11	NE	0	3	3	NE
D-12	NE	0	1	1	NE

All Depths in this Summary Table are Approximate

NE: Not Encountered

PWR: Partially Weathered Rock

### EVALUATIONS AND RECOMMENDATIONS

The following evaluations and recommendations are based on the information available on the proposed construction, the data obtained from the test borings, and our experience with soils and subsurface conditions similar to those encountered at this site. Because of the test borings represent a very small statistical sampling of subsurface conditions, it is possible that conditions different from those indicated by the test borings could be encountered during supplemental exploration and during construction.

#### Geotechnical Considerations

The following geotechnical characteristics of the site should be considered for planning and design:

- Existing fill materials were encountered in boring D-7 extending to a depth of about 3 feet. Standard penetration testing suggests that moderate compactive effort was used at the time of fill placement. It is important to note that the consistency and composition of fill materials can vary drastically over relatively short distances. Existing fill materials should be thoroughly evaluated where encountered, and any loose or unstable fill material should be excavated and replaced if it cannot be adequately densified in place.
- Partially weathered rock was encountered just below surface materials in 11 of the 12 soil test borings. We expect difficult excavation conditions to be encountered for any utility installation, minor grading, or foundation construction that requires excavation below current grades. Excavation of partially weathered rock typically requires large equipment capable of ripping. However, we expect relatively small equipment to be used for this project. We expect impact hammers to be necessary to remove



partially weathered rock where necessary. For planning purposes, we recommend assuming that blasting will be necessary to remove material below the depth of auger refusal.

- A water well is located within the construction area. If the well is not incorporated into the new building addition, it must be properly abandoned in accordance with the Georgia Water Wells Standards Act of 1985.
- At the time of drilling, no groundwater was encountered in the borings. We do not expect groundwater to be a major hindrance to design or construction of the building addition.
- Based on the results of the soil test borings, it is our opinion that the planned school building can be supported on conventional shallow foundations. For planning purposes, we recommend assuming an allowable bearing pressure of 4,000 psf for a maximum column load of 200 kips or less and wall loads not exceeding 4 kips per lineal foot. Once a site plan, finished floor elevation, and structural loading have been developed, please allow us the opportunity to assess whether this recommended allowable foundation bearing pressure is applicable.
- Based on the results of the test borings and following the calculation procedure in the 2018 International Building Code (Chapter 20, ASCE 7-16), the *Site Class* for the site is *C*. The mapped and design spectral response accelerations are as follows:  $S_S=0.425$ ,  $S_1=0.119$ ,  $S_{DS}=0.369$ ,  $S_{D1}=0.119$ .

The following sections provide recommendations regarding these issues and other geotechnical aspects of the project.

### Existing Fill Materials

Fill materials were encountered in one of the test borings. There are several important facts that should be considered regarding existing fill materials and the limitations of subsurface exploration.

- The quality of existing fill materials can be highly variable, and test borings are often not able to detect all of the zones or layers of poor quality fill materials.
- Layers of poor quality fill materials that are less than about 2½ to 5 feet thick may often remain undetected by soil test borings due to the discrete-interval sampling method used in this exploration.
- The interface between existing fill materials and the original ground surface may include a layer of organic material that was not properly stripped off during the original grading. Depending on its relationship to the foundation and floor slab bearing surfaces, an organic layer might adversely affect support of footings and floor slabs. If such organic layers are encountered during construction, it may be necessary to “chase out” the organic layer by excavating the layer along with overlying soils.
- Subsurface exploration is simply not capable of disclosing all conditions that may require remediation.

### General Site Preparation

Any topsoil, vegetation, roots, pavement materials, existing foundations, and demolition debris should be completely removed from the construction area. Clearing, grubbing, and stripping should be performed only during dry weather conditions. Operation of heavy equipment on the site during wet conditions could result in excessive rutting and mixing of debris or topsoil with underlying soils. All excavations resulting from rerouting of underground utilities or demolition of foundations or other underground structures should be backfilled in accordance with the *Structural Fill* section of this report.

We recommend that areas to receive structural fill be proofrolled prior to placement of structural fill. Areas of proposed excavation should be proofrolled after rough finished subgrade is achieved. Proofrolling should be performed with multiple passes in at least two directions using a fully loaded tandem axle dump truck weighing at least 18 tons. Proofrolling must be avoided within 10 feet of existing buildings and hardscapes to remain. If low consistency soils are encountered that cannot be adequately densified in place, such soils should be removed and replaced with well compacted fill material placed in accordance with the *Structural Fill* section of this report. Proofrolling should be observed by Geo-Hydro to determine if remedial measures are necessary.

For budgeting purposes, we suggest considering that approximately 10 percent of the building footprint will require undercutting and replacement extending to a depth of about 2 feet below current grades in fill areas or 2 feet below final grades in cut areas. The suggested stabilization approach is intended only as a tool to estimate a cost associated with ground stabilization. The need for, extent of, location, and optimal method of ground stabilization should be determined by Geo-Hydro at the time of construction based on actual site conditions. The extent and cost of ground stabilization may exceed the suggested budgetary estimate.

During site preparation, burn pits or trash pits may be encountered. Such buried material can be present in isolated areas which are not detected by the soil test borings. Any buried debris or trash found during the construction operation should be thoroughly excavated and removed from the site.

### Excavation Characteristics

All of the borings encountered partially weathered rock at depths ranging from just below surface materials to about 3 feet. Conditions causing auger refusal were encountered in all of the borings at depths ranging from 1 to 6 feet. We expect difficult excavation conditions to be encountered during utility installation, foundation construction, or any minor grading requiring excavation below current elevations.

Excavation of partially weathered rock requires large equipment capable of ripping. Because of the size of equipment expected to be used for this project, we expect impact hammers to be necessary to remove partially weathered rock where encountered.

For planning purposes, we recommend assuming that blasting will be necessary to remove partially material below the depth of auger refusal.

For construction bidding and field verification purposes it is common to provide a verifiable definition of rock in the project specifications. The following are typical definitions of mass rock and trench rock:

- **Mass Rock:** Material that cannot be excavated with a single-tooth ripper drawn by a crawler tractor having a minimum draw bar pull rated at 56,000 pounds (Caterpillar D-8K or equivalent), and occupying an original volume of at least one cubic yard.
- **Trench Rock:** Material occupying an original volume of at least one-half cubic yard which cannot be excavated with a hydraulic excavator having a minimum flywheel power rating of 123 kW (165 hp); such as a Caterpillar 322CL, John Deere 230C LC, or a Komatsu PC220LC-7; equipped with a short tip radius bucket not wider than 42 inches.

The foregoing definitions are based on large equipment typically utilized for mass grading. Subsequent excavations for building foundations, retaining walls, and underground utilities are often performed with smaller equipment such as rubber-tired backhoe/loaders or even mini-excavators. Contractors will often request additional payment for mobilizing larger equipment than that which was anticipated during preparation of their construction bid. The amount of additional compensation, if any, and the minimum equipment size necessary to qualify for any additional compensation should be defined before the start of construction.

### Blasting

In most cases rock excavation is performed by blasting. Standard blasting procedures include drilling through the materials to be blasted to introduce the explosives and covering up the area to be blasted to prevent flying debris. The area to be blasted is typically covered with several feet of soil or a blast mat. Alternatively, the existing soil overburden can be left in place, which in most cases will eliminate the need for a soil cover or a blast mat.

**Blasting generates ground vibrations that can be detrimental to adjacent structures.** Research by the United States Bureau of Mines and other organizations provides limits for safeguarding adjacent structures during blasting operations. A peak particle velocity of 2 inches per second is generally recognized as a conservative limit, and is the maximum peak particle velocity allowed by the Georgia Blasting Standards Act of 1978.

State and local laws require that precondition surveys of neighboring properties be performed prior to conducting blasting activities. Typical requirements are to conduct a precondition survey of structures and facilities within a 1,000-foot radius of the blast site. Vibration monitoring is also required in all four compass directions at the nearest structure not owned by the developer/owner. Some municipalities have variations of these requirements, and the local requirements should be reviewed prior to beginning blasting activities.

### Reuse of Excavated Materials

Based on the results of test borings, the majority of fill materials encountered on site should be suitable for reuse as structural fill after routine moisture content adjustment. Geo-Hydro should observe the excavation of existing fill materials to evaluate their suitability for reuse. Soft, unstable fill soils free of deleterious materials may be reusable after routine moisture adjustment.

It is important to establish as part of the construction contract whether soils having elevated moisture content will be considered suitable for reuse. We often find this issue to be a point of contention and a source of delays and change orders. From a technical standpoint, soils with moisture contents wet of optimum as determined by the standard Proctor test (ASTM D698) can be reused provided that the moisture is properly adjusted to within the workable range. From a practical standpoint, wet soils can be very difficult to dry in small or congested sites and such difficulties should be considered during planning and budgeting. A clear understanding by the general contractor and grading subcontractor regarding the reuse of excavated soils will be important to avoid delays and unexpected cost overruns.

Partially weathered rock materials will be suitable for reuse as structural fill only if they break down into a reasonably well-graded material that can be satisfactorily compacted. The presence of cobble size or boulder size material, which does not break down under the action of compaction equipment, will limit the suitability of partially weathered rock materials. Engineering judgment will be required in the field to evaluate the acceptability of partially weathered rock materials for reuse as structural fill.

For planning purposes, blast rock should be considered unsuitable for reuse as structural fill.

### Structural Fill

Materials selected for use as structural fill should be free of organic matter, waste construction debris, and other deleterious materials. The material should not contain rocks having a diameter over 4 inches. It is our opinion that the following soils represented by their USCS group symbols will typically be suitable for use as structural fill and are usually found in abundance in the Valley and Ridge Province: (SM), (ML), and (CL). The following soil types are typically suitable but are not abundant in the Valley and Ridge Province: (SW), (SP), (SP-SM), and (SP-SC). The following soil types are considered unsuitable: (OL), (OH), and (Pt).

Highly plastic silt or clay, (MH) or (CH) soils, should be used with extreme caution. Such soils will require protection against desiccation or inundation during the construction process. Soils which have a liquid limit greater than 60 and a plasticity index greater than 35 will require blending with less plastic materials to result in lower Atterberg limits.

Laboratory Proctor compaction tests and classification tests should be performed on representative samples obtained from the proposed borrow material to provide data necessary to determine acceptability and for quality control. The moisture content of suitable borrow soils should generally be no more than 3 percentage points below or above optimum at the time of compaction. Tighter moisture limits may be necessary with certain soils.

Suitable fill material should be placed in thin lifts. Lift thickness depends on the type of compaction equipment, but in general, maximum lifts of 8 inches loose measurement are recommended. The soil should be compacted by heavy compaction equipment such as a self-propelled sheepsfoot roller. Within small excavations such as in utility trenches, around manholes, or behind retaining walls, we recommend the use of “wacker packers” or “Rammax” compactors to achieve the specified compaction. Maximum loose lift thicknesses of 4 to 6 inches are recommended in small area fills.

We recommend that structural fill be compacted to at least 95 percent of the standard Proctor maximum dry density (ASTM D698). The upper 12 inches of floor slab subgrade soils should be compacted to at least 98 percent of the standard Proctor maximum dry density. Following Georgia DOT guidelines, the upper 12 inches of pavement subgrade soils should be compacted to at least 100 percent of the standard Proctor maximum dry density. Additionally, the in-place maximum dry density of structural fill should be no less than 90 pcf. Geo-Hydro should perform density tests during fill placement.

### Earth Slopes

Temporary construction slopes should be designed in strict compliance with OSHA regulations. The exploratory borings indicate that within the likely excavation depths for this project, soil types A, B, and C as well as stable rock as defined in 29 CFR 1926 Subpart P may be encountered. Temporary construction slope gradients will vary from 1.5H:1V to vertical depending on the material forming the slope. Based on OSHA rules, temporary slopes for each material are as follows:

Material Classification	Maximum Slope Gradient for Excavations Less Than 20 Feet Deep
Stable Rock	Vertical
Type A – Partially Weathered Rock	$\frac{3}{4}$ H:1V
Type B – Residual Soil	1H:1V
Type C – Fill Materials or Any Soil Below Groundwater Level	$1\frac{1}{2}$ H:1V

Temporary construction slopes should be closely observed on a daily basis by the contractor’s “competent person” for signs of mass movement: tension cracks near the crest, bulging at the toe of the slope, etc. The responsibility for excavation safety and stability of construction slopes should lie solely with the contractor.

We recommend that extreme caution be observed in trench excavations. Several cases of loss of life due to trench collapses in Georgia point out the lack of attention given to excavation safety on some projects. We recommend that applicable local and federal regulations regarding temporary slopes, and shoring and bracing of trench excavations be closely followed.

Formal analysis of slope stability was beyond the scope of work for this project. Based on our experience, permanent cut or fill slopes should be no steeper than 2H:1V to maintain long term stability and to provide ease of maintenance. The crest or toe of cut or fill slopes should be no closer than 10 feet to any foundation or to the edge of any pavement that will handle truck traffic. The crest or toe should be no closer than 5 feet to the edge of any pavements supporting cars or light truck traffic or parking. Erosion protection of

slopes during construction and during establishment of vegetation should be considered an essential part of construction.

### Earth Pressure (Cast-in-Place Structures)

Three earth pressure conditions are generally considered for retaining wall design: "at rest", "active", and "passive" stress conditions. Retaining walls which are rigidly restrained at the top and will be essentially unable to rotate under the action of earth pressure (such loading dock walls) should be designed for "at rest" conditions. Retaining walls which can move outward at the top as much as 0.5 percent of the wall height (such as free-standing walls) should be designed for "active" conditions. For the evaluation of the resistance of soil to lateral loads the "passive" earth pressure must be calculated. It should be noted that full development of passive pressure requires deflections toward the soil mass on the order of 1.0 percent to 4.0 percent of total wall height.

Earth pressure may be evaluated using the following equation:

$$p_h = K (D_w Z + q_s) + W_w(Z-d)$$

where:  $p_h$  = horizontal earth pressure at any depth below the ground surface (Z).

$W_w$  = unit weight of water

Z = depth to any point below the ground surface

d = depth to groundwater surface

$D_w$  = wet unit weight of the soil backfill (depending on borrow sources). The partially saturated unit weight of most residual soils may be expected to range from approximately 115 to 125 pcf. Below the groundwater level,  $D_w$  must be the buoyant weight.

$q_s$  = uniform surcharge load (add equivalent uniform surcharge to account for construction equipment loads)

K = earth pressure coefficient as follows:

<u>Earth Pressure Condition</u>	<u>Coefficient</u>
At Rest ( $K_o$ )	0.53
Active ( $K_a$ )	0.36
Passive ( $K_p$ )	2.8

The groundwater term,  $W_w(Z-d)$ , should be used if no drainage system is incorporated behind retaining walls. If a drainage system is included which will not allow the development of any water pressure behind the wall, then the groundwater term may be omitted. The development of excessive water pressure is a common cause of retaining wall failures. Drainage systems should be carefully designed to ensure that long term permanent drainage is accomplished.

The above design recommendations are based on the following assumptions:

- Horizontal backfill
- 95 percent standard Proctor compactive effort on backfill (ASTM D698)
- No safety factor is included

For convenience, equivalent fluid densities are frequently used for the calculation of lateral earth pressures. For "at rest" stress conditions, an equivalent fluid density of 66 pcf may be used. For the "active" state of stress an equivalent fluid density of 45 pcf may be used. These equivalent fluid densities are based on the assumptions that drainage behind the retaining wall will allow *no* development of hydrostatic pressure; that native clayey silts or silty clays will be used as backfill; that the backfill soils will be compacted to at least 95 percent of standard Proctor maximum dry density; that backfill will be horizontal; and that no surcharge loads will be applied.

For analysis of sliding resistance of the base of a cast-in-place concrete retaining wall, the coefficient of friction may be taken as 0.35 for the soils at the project site. This is an ultimate value and an adequate factor of safety should be used in design. The force that resists base sliding is calculated by multiplying the normal force on the base by the coefficient of friction. Full development of the frictional force could require deflection of the base of roughly 0.1 to 0.3 inches.

### Foundation Design

At the time of this report, no structural loading information was available to us. The following recommendations are based on an assumed maximum column load of 200 kips and maximum wall loads not exceeding 4 kips per lineal foot. After general site preparation and site grading have been completed in accordance with the recommendations of this report, it is our opinion that the proposed building addition can be supported using conventional shallow foundations. We recommend that footings be designed using an allowable bearing pressure of 4,000 psf. Geo-Hydro should review the site plan, structural loading, and finished floor elevation once developed to confirm that this allowable bearing pressure is applicable to the final version of the project.

In addition, we recommend a minimum width of 24 inches for column footings and 18 inches for continuous wall footings to prevent general bearing capacity failure. Footings should bear at a minimum depth of 18 inches below the prevailing exterior ground surface elevation to avoid potential problems due to frost heave.

The recommended allowable bearing pressure is based on an estimated maximum total foundation settlement no greater than approximately 1 inch, with anticipated differential settlement between adjacent columns not exceeding about ½ inch. If the architect or structural engineer determines that the estimated total or differential settlement cannot be accommodated by the proposed structure, please contact us.

Because some foundation excavations may occur adjacent to the existing building, care should be taken to avoid undermining existing foundations and floor slabs. Generally, new footings located adjacent to existing footings should be constructed to bear at the same elevation as the existing footings. The



responsibility for preserving foundation support for the existing buildings should lie solely with the contractor.

Foundation bearing surface evaluations should be performed in all footing excavations prior to placement of reinforcing steel. These evaluations should be performed by Geo-Hydro to confirm that the design allowable soil bearing pressure is available. Foundation bearing surface evaluations should be performed using a combination of visual observation, hand augering, and portable dynamic cone penetrometer testing (ASTM STP-399).

Because of natural variation, it is possible that some of the soils at the project site may have an allowable bearing pressure less than the recommended design value. Likewise, existing fill materials can be highly variable, and may have an allowable bearing pressure less than the recommended design value. Therefore, foundation bearing surface evaluations will be critical to aid in the identification and remediation of these situations.

Remedial measures should be based on actual field conditions. However, in most cases we expect the use of the stone replacement technique to be the primary remedial measure. Stone replacement involves the removal of soft or loose soils, followed by replacement with well-compacted graded aggregate base (GAB) meeting Georgia DOT specifications for gradation. Stone replacement is generally performed to depths ranging from a few inches to as much as 2 times the footing width, depending on the actual conditions. For budgetary purposes, we suggest considering that as much as 10 percent of the foundation excavations will require over excavation and stone replacement extending to a depth of 2 feet below bearing elevation. The actual quantity of stone replacement will be different and may exceed the provided estimate.

### Seismic Design

Based on the results of the test borings and following the calculation procedure in the 2018 International Building Code (Chapter 20, ASCE 7-16), the *Site Class* for the site is C. The mapped and design spectral response accelerations are as follows:  $S_S=0.425$ ,  $S_1=0.119$ ,  $S_{DS}=0.369$ ,  $S_{D1}=0.119$ .

Based on the information obtained from the soil test borings, it is our opinion that the potential for liquefaction of the residual soils at the site due to earthquake activity is relatively low.

### Floor Slab Subgrade Preparation

The soil subgrade in the area of concrete slab-on-grade support is often disturbed during foundation excavation, plumbing installation, and superstructure construction. We recommend that the floor slab subgrade be evaluated by Geo-Hydro immediately prior to beginning floor slab construction. If low consistency soils are encountered that cannot be adequately densified in place, such soils should be removed and replaced with well-compacted fill material placed in accordance with the *Structural Fill* section of this report or with well-compacted graded aggregate base (GAB).



Assuming that the top 12 inches of floor slab subgrade soils are compacted to at least 98 percent of the standard Proctor maximum dry density, we recommend that a modulus of subgrade reaction of 120 pci be used for design.

### Moisture Control for Concrete Slabs

To prevent the capillary rise of groundwater from adversely affecting the concrete slab-on-grade floor, we recommend that slab-on-grade floors be underlain by a minimum 4-inch thickness of open-graded stone. Use of #57 crushed stone meeting Georgia DOT specifications for gradation is suggested. The stone must be covered by a vapor retarder. We suggest polyethylene sheeting at least 10 mils thick as a minimum vapor retarder.

In areas where floor slabs may be subjected to vehicular traffic including forklifts or other relatively heavy wheeled equipment, we recommend that slab-on-grade floors be underlain by a minimum 5-inch thickness of graded aggregate base (GAB) compacted to at least 98 percent of the modified Proctor maximum dry density (ASTM D1557). The GAB must be covered by a vapor retarder as suggested above.

### Flexible Pavement Design

Based on our experience with similar projects, assuming standard pavement design parameters, and contingent upon proper pavement subgrade preparation, we recommend the following pavement sections:

#### Entrance/Exit Driveways and Truck Traffic Areas

Material	Thickness (inches)
Asphaltic Concrete 9.5mm Superpave Type II	2
Asphaltic Concrete 19mm Superpave	2
Graded Aggregate Base (GAB) (Base Course)	8
Subgrade compacted to at least 100% standard Proctor maximum dry density (ASTM D698)	12

#### Automobile Parking and Automobile Traffic Only

Material	Thickness (inches)
Asphaltic Concrete 9.5mm Superpave Type II	2
Graded Aggregate Base (GAB) (Base Course)	6
Subgrade compacted to at least 100% standard Proctor maximum dry density (ASTM D698)	12

A concrete thickness of 7 inches is recommended for the approach and collection zone in front of any dumpsters, loading dock aprons, and designated truck turn-around areas. Please refer to the *Concrete Pavement* section of this report for concrete pavement recommendations.

Similar to floor slab subgrades, pavement subgrades generally deteriorate due to construction activities between the time of general site preparation and pavement construction. The top 12 inches of pavement subgrade soils must be compacted to at least 100 percent of the standard Proctor maximum dry density (ASTM D698). Scarification and moisture adjustment will likely be required to achieve the recommended

subgrade compaction level. Allowances for pavement subgrade preparation should be considered for budgeting and scheduling.

GAB must be compacted to at least 98 percent of the modified Proctor maximum dry density (ASTM D1557).

All pavement construction should be performed in general accordance with Georgia DOT specifications. Proper subgrade compaction, adherence to Georgia DOT specifications, and compliance with project plans and specifications, will be critical to the performance of the constructed pavement.

### Concrete Pavement

A rigid Portland cement concrete pavement may be considered. Although usually more costly, a Portland cement concrete pavement is typically more durable and requires less maintenance throughout the life cycle of the facility. Concrete thicknesses of 5 inches in automobile parking areas and 6 inches in driveways and truck traffic areas are recommended. A concrete thickness of 7 inches is recommended for the approach and collection zone in front of the dumpster, loading dock aprons, and designated truck turn-around areas. A 600-psi flexural strength concrete mix (approximately 4,500 psi compressive strength) with 4 to 6 percent air entrainment should be used. The concrete pavement should be underlain by no less than 5 inches of compacted graded aggregate base (GAB). GAB should be compacted to at least 98 percent of the modified Proctor maximum dry density (ASTM D1557). The top 12 inches of soil subgrade should be compacted to at least 100 percent of the standard Proctor maximum dry density (ASTM D698).

The concrete pavement may be designed as a “plain concrete pavement” with no reinforcing steel, or reinforcing steel may be used at joints. Construction joints and other design details should be in accordance with guidelines provided by the Portland Cement Association and the American Concrete Institute.

In general, all pavement construction should be in accordance with Georgia DOT specifications. Proper subgrade compaction, adherence to Georgia DOT specifications, and compliance with project plans and specifications will be critical to the performance of the constructed pavement.

### *Pavement Design Limitations*

*The pavement sections discussed above are based on our experience with similar type developments. After traffic information has been developed, we recommend that you allow us to review the traffic data and revise our recommendations as necessary.*

### Pavement Materials Testing

To aid in verifying that the pavement system is installed in general accordance with the design considerations, the following materials testing services are recommended:

- Density testing of subgrade materials.


- Proofrolling of pavement subgrade materials immediately prior to placement of graded aggregate base (GAB). This proofrolling should be performed the same day GAB is installed.
- Density testing of GAB and verification of GAB thickness. In-place density should be verified using the sand cone method (ASTM D1556).
- Coring of the pavement to verify thickness and density (asphalt pavement only).
- Preparation and testing of beams and cylinders for flexural and compressive strength testing (Portland cement concrete only). The total number of test specimens required will depend on the number of concrete placement events necessary to construct the pavement.

\* \* \* \* \*

We appreciate the opportunity to serve as your geotechnical consultant for this project. If you have any questions concerning this report or any of our services, please call us.

Sincerely,

GEO-HYDRO ENGINEERS, INC.

  
A. Marty Peninger, P.E.  
Senior Geotechnical Engineer  
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AMP/LEB/200734.20 - Davis Elementary School Addition - Trenton, GA

## APPENDIX

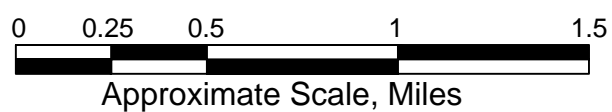
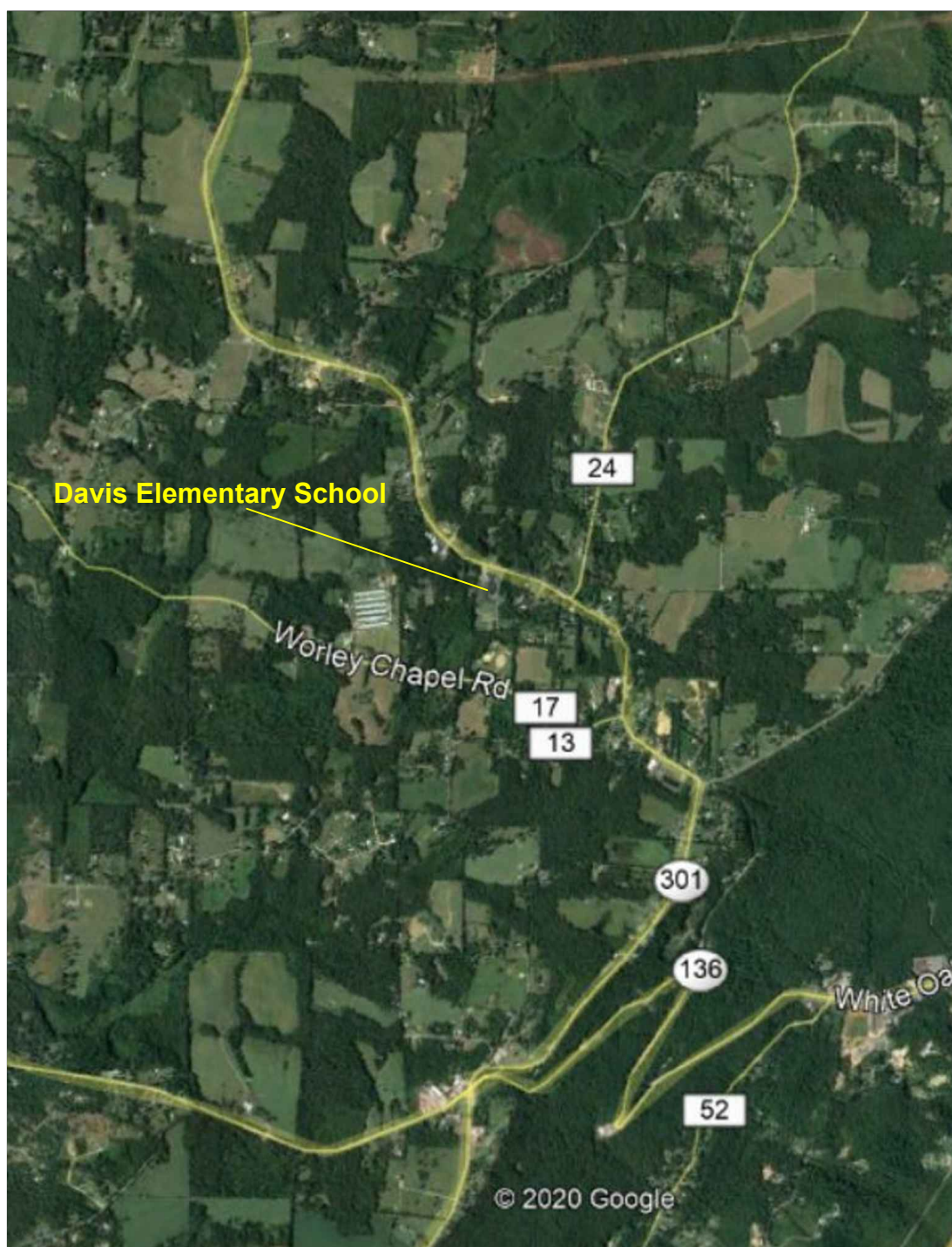
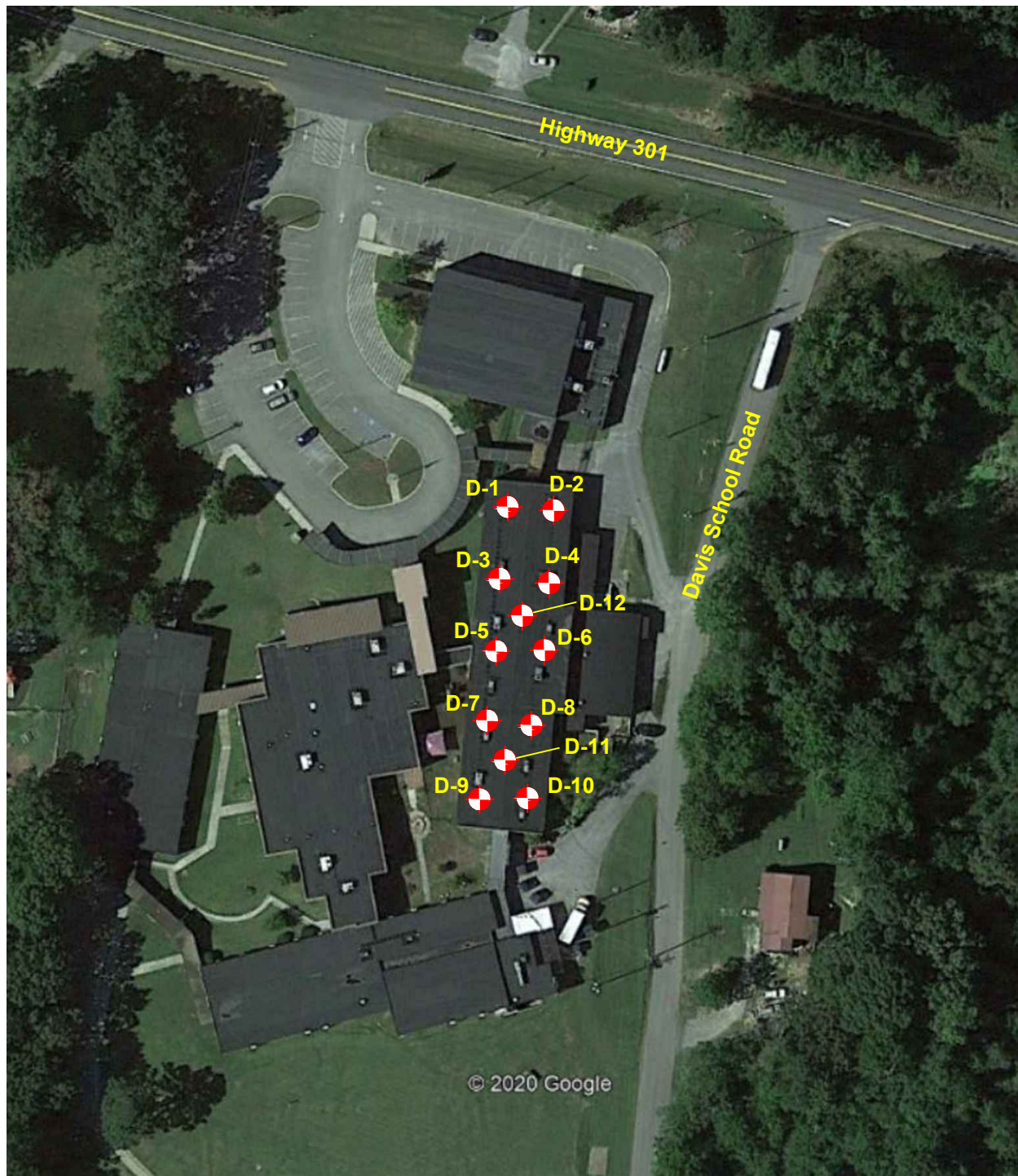


Figure 1: Site Location Plan

Davis Elementary School Addition  
5491 Highway 301  
Trenton, Georgia  
Geo-Hydro Project Number 200734.00





LEGEND:  Soil Test Boring



Approximate Scale: 1"=100'

Figure 2: Boring Location Plan

Davis Elementary School Addition  
5491 Highway 301  
Trenton, Georgia  
Geo-Hydro Project Number 200734.00

## Symbols and Nomenclature

### Symbols

█	Thin-walled tube (TWT) sample recovered
▢	Thin-walled tube (TWT) sample not recovered
●	Standard penetration resistance (ASTM D1586)
50/2"	Number of blows (50) to drive the split-spoon a number of inches (2)
65%	Percentage of rock core recovered
RQD	Rock quality designation - % of recovered core sample which is 4 or more inches long
GW	Groundwater
▼	Water level at least 24 hours after drilling
▽	Water level one hour or less after drilling
ALLUV	Alluvium
TOP	Topsoil
PM	Pavement Materials
CONC	Concrete
FILL	Fill Material
RES	Residual Soil
PWR	Partially Weathered Rock
SPT	Standard Penetration Testing

### Penetration Resistance Results

	Number of Blows, N	Approximate Relative Density
Sands	0-4	very loose
	5-10	loose
	11-20	firm
	21-30	very firm
	31-50	dense
	Over 50	very dense
	Number of Blows, N	Approximate Consistency
Silts and Clays	0-1	very soft
	2-4	soft
	5-8	firm
	9-15	stiff
	16-30	very stiff
	31-50	hard
	Over 50	very hard

### Drilling Procedures

Soil sampling and standard penetration testing performed in accordance with ASTM D 1586. The standard penetration resistance is the number of blows of a 140-pound hammer falling 30 inches to drive a 2-inch O.D., 1.4-inch I.D. split-spoon sampler one foot. Rock coring is performed in accordance with ASTM D 2113. Thin-walled tube sampling is performed in accordance with ASTM D 1587.

# D-1

## Test Boring Record



Project: <b>Davis Elementary School Addition</b>						Project No: <b>200734.20</b>	
Location: <b>5491 Highway 301 - Trenton, Georgia</b>						Date: <b>8/31/20</b>	
Method: <b>HSA- ASTM D1586</b>			GWT at Drilling: <b>Not Encountered</b>			G.S. Elev:	
Driller: <b>TSD - Auto Hammer</b>			GWT at 24 hrs: <b>N/A (Boring Backfilled)</b>			Logged By: <b>AMP</b>	

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)														
						0	10	20	30	40	50	60	70	80	90	100				
				Topsoil (Approximately 2 inches)																
				Partially weathered rock sampled as tan and brown silty fine sand (SM) (RESIDUUM)	50/4"															
				Auger Refusal at 1 foot																
	5																			
	10																			
	15																			

**Remarks:**



# D-2

## Test Boring Record



Project: <b>Davis Elementary School Addition</b>						Project No: <b>200734.20</b>														
Location: <b>5491 Highway 301 - Trenton, Georgia</b>						Date: <b>8/31/20</b>														
Method: <b>HSA- ASTM D1586</b>			GWT at Drilling: <b>Not Encountered</b>			G.S. Elev:														
Driller: <b>TSD - Auto Hammer</b>			GWT at 24 hrs: <b>N/A (Boring Backfilled)</b>			Logged By: <b>AMP</b>														
Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)														
						0	10	20	30	40	50	60	70	80	90	100				
				Topsoil (Approximately 1 inch)																
				Partially weathered rock sampled as purple and brown clayey fine sand (SC) (RESIDUUM)																
					50/5"															●
					50/1"															●
				Auger Refusal at 4 feet																
	5																			
	10																			
	15																			
Remarks:																				

# D-3

## Test Boring Record



Project: <b>Davis Elementary School Addition</b>						Project No: <b>200734.20</b>	
Location: <b>5491 Highway 301 - Trenton, Georgia</b>						Date: <b>8/31/20</b>	
Method: <b>HSA- ASTM D1586</b>			GWT at Drilling: <b>Not Encountered</b>			G.S. Elev:	
Driller: <b>TSD - Auto Hammer</b>			GWT at 24 hrs: <b>N/A (Boring Backfilled)</b>			Logged By: <b>AMP</b>	

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)															
						0	10	20	30	40	50	60	70	80	90	100					
				Topsoil (Approximately 2 inches)																	
				Partially weathered rock sampled as gray and tan fine sand with silt (SP-SM) (RESIDUUM)	50/1"																
				Auger Refusal at 3 feet																	
	5																				
	10																				
	15																				

**Remarks:**

# D-4

## Test Boring Record



Project: <b>Davis Elementary School Addition</b>						Project No: <b>200734.20</b>					
Location: <b>5491 Highway 301 - Trenton, Georgia</b>						Date: <b>8/31/20</b>					
Method: <b>HSA- ASTM D1586</b>			GWT at Drilling: <b>Not Encountered</b>			G.S. Elev:					
Driller: <b>TSD - Auto Hammer</b>			GWT at 24 hrs: <b>N/A (Boring Backfilled)</b>			Logged By: <b>AMP</b>					

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)														
						0	10	20	30	40	50	60	70	80	90	100				
				Topsoil (Approximately 2 inches)																
				Partially weathered rock sampled as light orange fine sand with silt (SP-SM) (RESIDUUM)	50/0"															
				Auger Refusal at 3 feet																
	5																			
	10																			
	15																			

**Remarks:**

# D-5

## Test Boring Record



Project: <b>Davis Elementary School Addition</b>						Project No: <b>200734.20</b>										
Location: <b>5491 Highway 301 - Trenton, Georgia</b>						Date: <b>8/31/20</b>										
Method: <b>HSA- ASTM D1586</b>			GWT at Drilling: <b>Not Encountered</b>			G.S. Elev:										
Driller: <b>TSD - Auto Hammer</b>			GWT at 24 hrs: <b>N/A (Boring Backfilled)</b>			Logged By: <b>AMP</b>										
Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)										
						0	10	20	30	40	50	60	70	80	90	100
				Topsoil (Approximately 2 inches)												
				Partially weathered rock sampled as gray and tan fine sand with silt (SP-SM) (RESIDUUM)												
				Auger Refusal at 4 feet												
	5															
	10															
	15															
Remarks:																

# D-6

## Test Boring Record



Project: <b>Davis Elementary School Addition</b>						Project No: <b>200734.20</b>									
Location: <b>5491 Highway 301 - Trenton, Georgia</b>						Date: <b>8/31/20</b>									
Method: <b>HSA- ASTM D1586</b>			GWT at Drilling: <b>Not Encountered</b>			G.S. Elev:									
Driller: <b>TSD - Auto Hammer</b>			GWT at 24 hrs: <b>N/A (Boring Backfilled)</b>			Logged By: <b>AMP</b>									
Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)									
					0	10	20	30	40	50	60	70	80	90	100
				Topsoil (Approximately 1 inch)											
				Partially weathered rock (No sampling performed)											
				Auger Refusal at 1 foot											
	5														
	10														
	15														
Remarks:															

# D-7

## Test Boring Record



Project: <b>Davis Elementary School Addition</b>						Project No: <b>200734.20</b>	
Location: <b>5491 Highway 301 - Trenton, Georgia</b>						Date: <b>8/31/20</b>	
Method: <b>HSA- ASTM D1586</b>			GWT at Drilling: <b>Not Encountered</b>			G.S. Elev:	
Driller: <b>TSD - Auto Hammer</b>			GWT at 24 hrs: <b>N/A (Boring Backfilled)</b>			Logged By: <b>AMP</b>	

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)
				Topsoil (Approximately 3 inches)		
				Loose light brown fine sand with silt (SP-SM) (FILL)		
				Partially weathered rock sampled as tan and gray fine sand with silt (SP-SM) (RESIDUUM)		
	5				50/1"	
				Auger Refusal at 6 feet		
	10					
	15					

**Remarks:**

# D-8

## Test Boring Record



Project: <b>Davis Elementary School Addition</b>						Project No: <b>200734.20</b>	
Location: <b>5491 Highway 301 - Trenton, Georgia</b>						Date: <b>8/31/20</b>	
Method: <b>HSA- ASTM D1586</b>			GWT at Drilling: <b>Not Encountered</b>			G.S. Elev:	
Driller: <b>TSD - Auto Hammer</b>			GWT at 24 hrs: <b>N/A (Boring Backfilled)</b>			Logged By: <b>AMP</b>	

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)														
						0	10	20	30	40	50	60	70	80	90	100				
				Topsoil (Approximately 1 inch)																
				Partially weathered rock (No sampling performed)																
				Auger Refusal at 1 foot																
	5																			
	10																			
	15																			

**Remarks:**

# D-9

## Test Boring Record



Project: <b>Davis Elementary School Addition</b>						Project No: <b>200734.20</b>	
Location: <b>5491 Highway 301 - Trenton, Georgia</b>						Date: <b>8/31/20</b>	
Method: <b>HSA- ASTM D1586</b>			GWT at Drilling: <b>Not Encountered</b>			G.S. Elev:	
Driller: <b>TSD - Auto Hammer</b>			GWT at 24 hrs: <b>N/A (Boring Backfilled)</b>			Logged By: <b>AMP</b>	

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)											
						0	10	20	30	40	50	60	70	80	90	100	
				Topsoil (Approximately 2 inches)													
				Partially weathered rock sampled as pink and tan fine sand with silt (SP-SM) (RESIDUUM)	50/1"												
				Auger Refusal at 3 feet													
	5																
	10																
	15																

**Remarks:**



# D-10

## Test Boring Record



Project: <b>Davis Elementary School Addition</b>						Project No: <b>200734.20</b>										
Location: <b>5491 Highway 301 - Trenton, Georgia</b>						Date: <b>8/31/20</b>										
Method: <b>HSA- ASTM D1586</b>			GWT at Drilling: <b>Not Encountered</b>			G.S. Elev:										
Driller: <b>TSD - Auto Hammer</b>			GWT at 24 hrs: <b>N/A (Boring Backfilled)</b>			Logged By: <b>AMP</b>										
Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)										
						0	10	20	30	40	50	60	70	80	90	100
				Topsoil (Approximately 3 inches)												
				Partially weathered rock sampled as tan-pink fine sand with silt (SP-SM) (RESIDUUM)	50/2"											
				Auger Refusal at 2 feet												
	5															
	10															
	15															
Remarks:																

# D-11

## Test Boring Record



Project: <b>Davis Elementary School Addition</b>						Project No: <b>200734.20</b>	
Location: <b>5491 Highway 301 - Trenton, Georgia</b>						Date: <b>8/31/20</b>	
Method: <b>HSA- ASTM D1586</b>			GWT at Drilling: <b>Not Encountered</b>			G.S. Elev:	
Driller: <b>TSD - Auto Hammer</b>			GWT at 24 hrs: <b>N/A (Boring Backfilled)</b>			Logged By: <b>AMP</b>	

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)														
						0	10	20	30	40	50	60	70	80	90	100				
				Topsoil (Approximately 3 inches)																
				Partially weathered rock sampled as gray and tan fine sand with silt (SP-SM) (RESIDUUM)																
				Auger Refusal at 3 feet	50/5"															
	5																			
	10																			
	15																			

**Remarks:**

# D-12

## Test Boring Record



Project: <b>Davis Elementary School Addition</b>						Project No: <b>200734.20</b>										
Location: <b>5491 Highway 301 - Trenton, Georgia</b>						Date: <b>8/31/20</b>										
Method: <b>HSA- ASTM D1586</b>			GWT at Drilling: <b>Not Encountered</b>			G.S. Elev:										
Driller: <b>TSD - Auto Hammer</b>			GWT at 24 hrs: <b>N/A (Boring Backfilled)</b>			Logged By: <b>AMP</b>										
Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)										
						0	10	20	30	40	50	60	70	80	90	100
				Topsoil (Approximately 3 inches)												
				Partially weathered rock (No sampling performed)												
				Auger Refusal at 1 foot												
	5															
	10															
	15															
Remarks:																



**SECTION 03300 - CAST-IN-PLACE CONCRETE**

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. Interior Slabs-on-grade.
  - 4. Exterior Slabs-on-grade.
  - 5. Concrete topping.

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.
  - 1. Water withheld for later addition at Project site is not permitted.
- 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. Shoring Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
  - 1. Shoring and Re-shoring: Indicate proposed schedule and sequence of shoring removal and installing and removing re-shoring. Structural engineer of record will not design or approve actual shoring elements.
- E. Samples: For waterstops and vapor retarder.
- F. 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. Vapor retarders.
  - 11. Semirigid joint filler.

12. Joint-filler strips.

G. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

H. Minutes of pre-installation conference.

I. Slab-on-grade joint layout drawings: Dimensioned plan drawings indicating location and frequency of control construction joints in slab-on-grade pursuant to the guidelines in the structural contract drawings.

### 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 or Type III.
    - 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 VAPOR RETARDERS

- A. Plastic Vapor Retarder: ASTM E 1745, Class B, Minimum 15 mil thickness. Include manufacturer's recommended adhesive or pressure-sensitive tape.

## 2.8 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.

## 2.9 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.

2.10 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.

2.11 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.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. All Building Elements Except Those Otherwise Noted: Proportion normal-weight concrete mixture as follows:
  - 1. Minimum Compressive Strength: 3,000 psi at 28 days.
  - 2. Maximum Water-Cementitious Materials Ratio: 0.55.
  - 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. Exterior slabs-on-grade. Proportion normal-weight concrete mixture as follows:
  - 1. Minimum Compressive Strength: 4,000 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.
- C. Concrete toppings at suspended slabs. Proportion structural lightweight concrete mixture as follows:
  - 1. Minimum Compressive Strength: 3,000 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: 5 inches, plus or minus 1 inch.
  - 4. Air Content: 3 percent, plus or minus 1.0 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
  - 5. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

2.13 FABRICATING REINFORCEMENT

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

2.14 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. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
  - 1. Do not remove shoring or re-shoring until measurements of floor flatness is complete.
- B. 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 VAPOR RETARDERS

- A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
  - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.

### 3.6 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.

### 3.7 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.

### 3.8 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.

### 3.9 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.

### 3.10 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.

### 3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, 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 restraighening 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) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for slabs-on-grade.
    - b. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade at gymnasium or other areas to receive wood or athletic flooring.
  - 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.

### 3.12 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. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.
- E. All slab areas where epoxy floor systems are specified shall be flood tested prior to the installation of epoxy coating.

### 3.13 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.

### 3.14 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.

### 3.15 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.

### 3.16 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.

### 3.17 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. Headed bolts and studs.
  3. Verification of use of required design mixture.
  4. Concrete placement, including conveying and depositing.
  5. Curing procedures and maintenance of curing temperature.
  6. 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 a minimum of 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 laboratory-cured specimen at 7 days, one set of two specimens at 28 days, and keep any remaining cylinders in reserve as necessary for future tests.
  - 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 does not comply with the Contract Documents.

END OF SECTION 03300

**SECTION 03300 - CAST-IN-PLACE CONCRETE**

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. Slabs-on-grade.

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.
  - 1. Water withheld for later addition at Project site is not permitted.
- 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. Shoring Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
  - 1. Shoring and Re-shoring: Indicate proposed schedule and sequence of shoring removal and installing and removing re-shoring. Structural engineer of record will not design or approve actual shoring elements.
- E. Samples: For waterstops and vapor retarder.
- F. 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. Vapor retarders.
  - 11. Semirigid joint filler.
  - 12. Joint-filler strips.

- G. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.
- H. Minutes of pre-installation conference.
- I. Slab-on-grade joint layout drawings: Dimensioned plan drawings indicating location and frequency of control construction joints in slab-on-grade pursuant to the guidelines in the structural contract drawings.

### 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 or Type III.
    - 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. 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 VAPOR RETARDERS

- A. Plastic Vapor Retarder: ASTM E 1745, Class B, Minimum 15 mil thickness. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.8 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.

2.9 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.

2.10 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.

## 2.11 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.

## 2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. All Building Elements Except Those Otherwise Noted: Proportion normal-weight concrete mixture as follows:
  - 1. Minimum Compressive Strength: 3,000 psi at 28 days.
  - 2. Maximum Water-Cementitious Materials Ratio: 0.55.
  - 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.

## 2.13 FABRICATING REINFORCEMENT

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

## 2.14 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. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
  - 1. Do not remove shoring or re-shoring until measurements of floor flatness is complete.
- B. 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 VAPOR RETARDERS

- A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
  - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.

### 3.6 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.

### 3.7 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.

### 3.8 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.

### 3.9 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.

### 3.10 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.

### 3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, 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 restraighening 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 restraighen 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) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for slabs-on-grade.
    - b. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade at gymnasium or other areas to receive wood or athletic flooring.
  - 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.

### 3.12 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. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.
- E. All slab areas where epoxy floor systems are specified shall be flood tested prior to the installation of epoxy coating.

### 3.13 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.

### 3.14 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.

### 3.15 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.

3.16 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.



3.17 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. Headed bolts and studs.
  - 3. Verification of use of required design mixture.
  - 4. Concrete placement, including conveying and depositing.
  - 5. Curing procedures and maintenance of curing temperature.
  - 6. 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 a minimum of 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 laboratory-cured specimen at 7 days, one set of two specimens at 28 days, and keep any remaining cylinders in reserve as necessary for future tests.
    - 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 does not comply with the Contract Documents.

END OF SECTION 03300

SECTION 042000 - 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.

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. Decorative CMUs, in the form of small-scale units.
  - 2. Brick.
  - 3. Colored mortar.
  - 4. Weep holes/vents.
  - 5. Cavity wall insulation
  - 6. 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 section 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, 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.
    - a. 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
- 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

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
  - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
  - 2. Provide **bullnose** units for outside corners, door and window jambs and other openings unless otherwise indicated. The first course immediately adjacent to the finished floor shall not have a bullnose corner.
- B. CMUs: ASTM C 90.
  - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
  - 2. Density Classification: Lightweight.
  - 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

### 2.3 MASONRY LINTELS

- A. Masonry Lintels: Built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

### 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: Utility
  - 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 \$1500.00 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 all 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 the following configuration:

- 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 MASONRY-CELL INSULATION

- A. Foam Insulation: Two-component consisting of amino-plast resin and a catalyst foaming agent surfactant. All exterior CMU wall cells to be filled.

1. Products:

- a. Core-Fill 500.

2.10 CAVITY-WALL INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV closed-cell product extruded with an integral skin.
- B. Extruded-Polystyrene Board Insulation with Increased R-Value: ASTM C 578, Type IV, 2" thick, closed-cell product with an integral skin.
- C. Adhesive: Type recommended by insulation board manufacturer for application indicated.

2.11 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.

## 2.12 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. Concrete facing brick.
    - b. 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 Karnak 220 AF. 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-CELL INSULATION

- A. Fill all exterior CMU wall cells with the specified foam insulation product. Inject foam into block cells from holes drilled in concealed spaces above the ceiling. Patch all holes once cells are completely filled. Follow all manufacturers instructions to ensure that all cells are filled.

### 3.8 MASONRY JOINT REINFORCEMENT

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

### 3.9 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. .

### 3.10 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to wall framing with 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.

### 3.11 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.

### 3.12 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.

### 3.13 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 for a distance of 3".
  - 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 with termination bar. 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.

### 3.14 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.

### 3.15 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.

### 3.16 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.

### 3.17 MASONRY WASTE DISPOSAL



A New Classroom Addition for:  
Davis Elementary School

SECTION 04200  
Unit Masonry

- 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

**SECTION 05120 - STRUCTURAL STEEL FRAMING**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
  - 1. Structural steel.
  - 2. Architecturally exposed structural steel.
  - 3. Grout.

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 (2016)", that support design loads.
- B. Architecturally Exposed Structural Steel: Structural steel designated as architecturally exposed structural steel in the Contract Documents.

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 303-16)".

- 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 3.1.1, 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 15<sup>th</sup> edition (2016).
  - 4. AISC's "Specification for Structural Joints Using High-Strength Bolts (2014)."
- 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 C, 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 55, 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 15<sup>th</sup> edition (2016).
  - 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. 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.
- C. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:
  - 1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
  - 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

## 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.
  - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

### 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 (AISC 360-16)."
- 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 High-Strength 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 15<sup>th</sup> edition (2016) 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 High-Strength 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

## **SECTION 05210 - STEEL JOIST FRAMING**

### **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 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 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

**SECTION 05310 - STEEL DECKING**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:

1. Roof 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."

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 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. Fasten roof-deck panels to light gage supporting members by #12 self-drilling screws.
- C. 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.

- D. 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.
- E. 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.
- F. 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.

### 3.3 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.

### 3.4 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

**SECTION 05400 - COLD-FORMED METAL FRAMING**

PART 1 - GENERAL

1.1 SUMMARY

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

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.
    - b. Roof Trusses: Vertical deflection of 1/240 of the span under total roof load.
  - 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.

1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. 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, "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 - Truss Design."
  2. 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 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:
1. Clark Steel Framing
  2. Craco Metals Manufacturing, LLC.
  3. Custom Stud, Inc.
  4. Dale/Incor.
  5. Design Shapes in Steel.
  6. Dietrich Metal Framing, a Worthington Industries Company.
  7. MarinoWare; a division of Ware Industries
  8. United Metal Products, Inc.

### 2.2 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

### 2.3 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. 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.

## 2.4 ROOF TRUSSES

- A. Roof Truss Members: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges.
  - 1. Minimum Base-Metal Thickness of truss top chord: 0.0538 inch.
  - 2. Minimum Base-Metal Thickness of other than Top Chord: 0.0329 inch, unless noted otherwise on structural drawings.
  - 3. Flange Width: 1-5/8 inches, minimum.

## 2.5 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.

## 2.6 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.

2.7 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.

2.8 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 TRUSS INSTALLATION

- A. Install, bridge, and brace trusses according to Shop Drawings and requirements in this Section.
- B. Truss Spacing: As indicated.

- C. Do not alter, cut, or remove framing members or connections of trusses.
- D. Erect trusses with plane of truss webs plumb and parallel to each other, align, and accurately position at spacings indicated.
- E. Erect trusses without damaging framing members or connections.
- F. Align webs of bottom chords and load-bearing studs or continuously reinforce tack to transfer loads to structure. Anchor trusses securely at all bearing points.
- G. Install continuous bridging and permanently brace trusses as indicated on Shop Drawings and designed according to LGSEA's Technical Note 551e, "Design Guide for Permanent Bracing of Cold-Formed Steel Trusses."

### 3.6 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

**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.
  - 3. Sheathing.
  - 4. Utility shelving.

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. Gypsum Sheathing Board:

- a. Domtar Gypsum.
- b. Georgia-Pacific Corp.
- c. National Gypsum Co.; Gold Bond Building Products Division.
- d. United States Gypsum Co.

## 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 AWPAC2 (lumber) and AWPAC9 (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 AWPAC4 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.

## 2.6 GYPSUM SHEATHING

- A. Gypsum Sheathing Board: Water-resistant-core gypsum sheathing board complying with ASTM C 79 with long edges surfaced with water-repellent paper and as follows:
1. Type: Regular.
  2. Edge Configuration: Square, for vertical application.
  3. Thickness: 1/2 inch (12.7 mm).

## 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 AWPAC 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.
- B. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- (19-by-38-mm actual-) size furring at 16 inches (406 mm) o.c., vertically.

### 3.4 GYPSUM SHEATHING

- A. General: Fasten gypsum sheathing to supports with galvanized roofing nails or divergent point galvanized staples. Nail or staple to comply with manufacturer's recommended spacing and referenced fastening schedule. Keep perimeter fasteners 3/8 inch (10 mm) from edges and ends of units. Fit units tightly against each other and around openings.
- B. Install 24-by-96-inch (609-by-2438-mm) sheathing horizontally with long edges at right angles to studs with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent board without forcing. Abut ends of boards over centers of studs and stagger end joints of adjacent boards not less than 1 stud spacing, 2 where possible.

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.
- B. Faced Mineral-Fiber Blanket Insulation: Thermal insulation combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665, Type III, Class A (blankets with reflective vapor-retarder membrane facing and flame spread of 25 or less);
- 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.
- 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.
- C. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.
  - 1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
- D. Set reflective, foil-faced units with not less than 0.75-inch (19-mm) air space in front of foil as indicated.
  - 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.

#### 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 07221 - METAL ROOF INSULATION

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Provide all labor, equipment, and materials to install roof insulation over the properly prepared deck substrate.

1.2 RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General Supplementary Conditions and Division 1 Specification Sections apply to this section.
- B. Related work specified elsewhere:
  - 1. Division 7 Section "Standing seam roof panels."
  - 2. Division 7 Section "Flashing and Sheet Metal."
  - 3. Division 7 Section "Roof Specialty and Accessory Items."

1.3 REFERENCES

ASTM A-167-94a	Specification for Stainless and Heat-Resisting Chromium Nickel Steel Plate, Sheet and Strip
ASTM A-653	Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process
ASTM B-29	Pig Lead
ASTM B-32	Solder Metal
ASTM C-165-95	Test Method for Measuring Compressive Properties of Thermal Insulation
ASTM C-208-95	Specifications for Cellulosic Fiber Insulating Board
ASTM C-209-92	Test Method for Cellulosic Fiber Insulating Board
ASTM C-272-91	Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
ASTM C-36	Specification for Gypsum Wallboard
ASTM C-518-91	Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C-578-92	Specification for Rigid, Cellular, Polystyrene Thermal Insulation
ASTM C-728-91	Specification for Perlite Thermal Insulation Board
ASTM D-5	Test Method for Penetration of Bituminous Materials
ASTM D-36	Test Method for Softening Point of Bitumen (Ring and Ball Apparatus)
ASTM D-312	Specification for Asphalt Used in Roofing
ASTM D-412-92	Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension
ASTM D-1621-94	Test Method for Compressive Properties of Rigid Cellular Plastics
ASTM D-1622	Test Method for Apparent Density of Rigid Cellular Plastics
ASTM D-1863	Specification for Mineral Aggregate Used on Built-Up Roofs
ASTM D-2126-94	Test Method for Response of Rigid Cellular Plastics to Thermal Humid Aging
ASTM D-2178	Standard Specification for Asphalt Glass Felts used in Roofing and Waterproofing
ASTM D-4601-94	Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing
ASTM D-5147	Sampling and Testing Modified Bituminous Sheet Material
CISPI	Cast Iron Soil Pipe Institute, Washington, D.C.
FM	Factory Mutual System, Norwood, Massachusetts

NRCA	National Roofing Contractors Association, Chicago, IL
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SDI	Steel Deck Institute, St. Louis, Missouri
SPIB	Southern Pine Inspection Bureau, Pensacola, Florida
UL	Underwriter's Laboratories, Inc., Northbrook, Illinois
FS HH-I-1972	Insulation Board, Polyisocyanurate
FS LLL-1-535B	Insulation Board, Thermal (Fiberboard)
WH	Warnock Hersey International, Inc., Middletown, Wisconsin

#### 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 01330.
- C. Provide approval letters from insulation manufacturer for use of their insulation within this particular roofing system type.
- D. Provide a sample of each insulation type.
- E. Shop Drawings
  - 1. Submit manufacturer's shop drawings indicating complete installation details of insulation system, including identification of each insulation block, sequence of installation, layout, roof slopes, thicknesses, crickets and saddles.
  - 2. Shop drawing shall include: Outline of roof, Roof slope, complete board layout of insulation components, thickness and the average "R" value for the completed insulation system.
- F. Certification
  - 1. Submit roof manufacturer's certification that insulation fasteners furnished are acceptable to roof manufacturer.
  - 2. Submit roof manufacturer's certification that insulation furnished is acceptable to roofing manufacturer as a component of roofing system and is eligible for roof manufacturer's system warranty.
  - 3. Submit certification that insulation and fastening system furnished is Tested and Approved by Factory Mutual for 1-90 Wind Up-Lift Requirements.

#### 1.5 QUALITY ASSURANCE

- A. Fire Classification, ASTM E-108
- B. Submit certification that the roof system furnished is approved by Factory Mutual, Underwriters Laboratories or Warnock Hersey for external Fire E-108 Class 1A and that the roof system is adhered properly to meet or exceed 1-90.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site with seals and labels intact, in manufacturer's original containers, dry and undamaged.
- B. Store all insulation materials in a manner to protect them from the wind, sun and moisture damage prior to and during installation. Any insulation that has been exposed to any moisture shall be removed from the project site.

- C. Keep materials enclosed in a watertight, ventilated enclosure (i.e. tarpaulins).
- D. Store materials off the ground. Any warped, broken or wet insulation boards shall be removed from the site.

## 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 INSULATION MATERIALS

- A. Provide thicknesses of insulation as indicated, provide combination of types and thicknesses to provide a complete system.

#### 1. RIGID POLYISOCYANURATE ROOF INSULATION

- a. Metal Roof Insulation Qualities: Rigid, closed cell Polyisocyanurate foam core with radiant barrier quality reinforced aluminum foil facers on both sides. Tape all seams with foil tape by same manufacturer.

- 1. Thickness: 3.25 in.
- 2. R-Value: Minimum 20.0

- b. Source

- 1. E'NRG'Y-2 By NRG Barriers, Inc.
- 2. Ultra Gard Gold II by Schuller Roofing Systems
- 3. GAFTEMP Isotherm R by GAF
- 4. Johns Manville.
- 5. Atlas Roofing Corp. – AC Foam Supreme
- 6. R-Max – Multimax FA
- 7. Dow – Tuff-R

#### 2. Insulation board shall meet the following requirements

- 1. UL, WH or FM listed under Roofing Systems
- 2. Federal Specification HH-I-1972, Class 1

#### 3. Physical Properties

Dimensional Stability	ASTM D-2126	2% max.
Compressive Strength	ASTM D-1621	25 psi min.
Vapor Permeability	ASTM E-96	1 perm max.
Foam Core Density	ASTM D-1622	2.0 pcf min.
Water Absorption	ASTM C-209	<1%

### 2.3 RELATED MATERIALS- where applicable

- A. Fiber Cant and Tapered Edge Strips: Performed rigid insulation units of sizes/shapes indicated, matching insulation board or of perlite or organic fiberboard, as per the approved manufacturer.

- 1. Acceptable Manufacturers
  - a. Celotex

- b. Johns Manville
  - c. International Permalite, Inc.
  - d. Approved Equivalent
- B. Protection Board: Premolded semi-rigid asphalt composition board ½ in.
- C. Roof Board Joint Tape: 6" wide glass fiber mat with adhesive compatible with insulation board facers.
- D. Asphalt: ASTM D-312, Type III Steep Asphalt.
- E. Metal Deck Foam Adhesive: Type recommended by insulation manufacturer and approved by FM and UL for indicated ratings.
- F. Fasteners
  - 1. Corrosion resistant screw fastener as recommended by roof membrane manufacturer.
  - 2. Factory Mutual Tested and Approved with 3 in. coated disc for 1-90 rating, length required to penetrate metal deck one inch.
  - 3. Minimum pull out resistance of 800 lbs.

### PART 3 - EXECUTION

#### 3.1 INSPECTION OF SURFACES

- A. Roofing contractor shall be responsible for preparing an adequate substrate to receive insulation.
  - 1. Verify that work which penetrates roof deck has been completed.
  - 2. Verify that wood nailers are properly and securely installed.
  - 3. Examine surfaces for defects, rough spots, ridges, depressions, foreign material, moisture, and unevenness.
  - 4. Do not proceed until defects are corrected.
  - 5. Do not apply insulation until substrate is sufficiently dry.
  - 6. Broom clean substrate immediately prior to application.
  - 7. Use additional insulation to fill depressions and low spots that would otherwise cause ponding water.
  - 8. Verify that temporary roof has been completed.

#### 3.2 INSTALLATION

- A. Attachment with Mechanical Fasteners.
  - 1. This is for the areas of that have slope metal decking. Approved polyisocyanurate insulation board shall be fully attached to the deck with an approved mechanical fastening system. As a minimum, the amount of fasteners shall be in accordance with manufacturer's recommendation for FM 1-90 approved system.
  - 2. Filler pieces of insulation require at least two fasteners per piece if size of insulation is less than four square feet.
  - 3. Spacing pattern of fasteners shall be as per manufacturer's recommendations to meet the FM requirements. Placement of any fastener from edge of insulation board shall be a minimum of three inches, and a maximum of six inches.
  - 4. Minimum penetration into deck shall be as recommended by the fastener manufacturer. There is a one inch (1") minimum for metal, wood and structural concrete decks where not specified by the manufacturer.

#### 3.3 CLEANING

- A. Remove debris and cartons from roof deck. Leave insulation clean and dry, ready to receive roofing membrane.

END OF SECTION

## **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**

- 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 aquaflash® liquid and aquaflash® 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. Damproofing for Exiterior Sheathing system: Dryvit Backstop NT or prior approved equal. Prior approval is required per Supplementary General Conditions, and alternate manufacturers must be approved per written and issued addendum a minimum of fifteen (14) days prior to the bid date. Approved Manufacturers, meeting the requirements of this specification, are as follows.

1. StoGuard by Sto Corp.
2. Prosoco R-Guard

### **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.
  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. Min 12 DFT

### **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 07411 - ARCHITECTURAL METAL ROOF PANELS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Work Included: The contractor shall provide all material, labor, administration and other items necessary to provide a complete architectural structural batten standing seam metal roof system complying with performance requirements indicated and capable of withstanding structural movement, thermally induced movement and exposure to weather without failure or infiltration of water into the building interior.
- B. Coordinate architectural standing seam metal roof system with roofing substructure work.
- C. Documents affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary General Conditions, and Sections in Division 1 of these Specifications.
- D. One Manufacturer shall provide all work associated this section and section 07415 - Preformed Metal Wall panel system

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Preformed and prefinished manufacturer's fully engineered architectural standing seam metal roof system with continuous interlocking seams, concealed clips and fastening devices.
  - 2. Color coordinated ridge, hip, valley, gable, eave, corner, rake, headwall, counter flashings and miscellaneous flashings, attaching devices, gutters and downspouts.
  - 3. Provide concealed clips, fasteners, metal closures, factory and field applied sealants as necessary to meet design criteria and ensure a weather tight installation.
  - 4. Bituthane membrane underlayment.
- B. Related Sections include the following:
  - 1. Division 1 Section "Alternates" for description of alternates related to the metal roof system.
  - 2. Division 5 Section "Steel Deck" for steel roof deck supporting metal roof panels.
  - 3. Division 5 Section "Cold-Formed Metal Framing" for secondary support framing supporting metal roof panels.
  - 4. Division 6 Section "Rough Carpentry" for nailers and miscellaneous blocking.
  - 5. Division 7 Section "Metal Wall Panels" for factory-formed metal wall and soffit panels.
  - 6. Division 7 Section "Metal roof insulation"
  - 7. Division 7 Section "Sheet Metal Flashing and Trim" for copings, flashings and other sheet metal work not part of the architectural standing seam metal roof system.
  - 8. Division 7 Section "Joint Sealants" for field-applied sealants not otherwise specified in this Section.

#### **1.3 DEFINITIONS**

- A. Architectural Standing Seam Metal Roof System Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, thermal insulation, underlayment, gutters, downspouts and accessories necessary for a complete weather tight roofing system.

#### **1.4 SYSTEM DESCRIPTION**

- A. DESIGN REQUIREMENTS:
  - 1. The architectural standing seam metal roof system, including: panels, flashings, attachment clips and attachment screws shall be designed by the standing seam metal roof system manufacturer to meet the local building code. The design criteria shall include the following:
    - a. Listing of applicable loads.
    - b. Listing of the building importance factor (life safety factor).
    - c. Design wind speed.

- d. Building exposure factor.
  - e. Other necessary criteria.
  2. The architectural standing seam metal roof manufacturer shall provide an engineered analysis of the roofing system assembly, sealed by a registered professional Engineer employed by the manufacturer, verifying that the product and attachment methods will resist wind pressures imposed upon it pursuant to the applicable building codes and that the standing seam metal roof system fully complies with all specified requirements.
  3. The architectural standing seam metal roof system shall bear fully documented proof that it has been independent laboratory evaluated using the U.S. Army Corps of Engineers Guide Specification (CEGS) 07416.
    - a. "Proof" shall be defined as both the manufacturer and the product being included in the document entitled, "List of Approved Standing Seam Metal Roof Systems" as published by the U.S. Corps of Engineers.
  4. Provide UL-90 rated roofing panels that have been tested in accordance with UL 580 protocol.
  5. Provide factory preformed architectural standing seam metal roofing system that has been pretested and certified by the manufacturer to comply with specified requirements under installed conditions.
  6. Provide one-piece, single length roof panels without need for interior laps or splices.
  7. Provide continuously interlocking architectural standing seam metal roofing panels that inherently increases load span capability, stiffness and flexural stress handling capacity.
  8. Provide architectural standing seam metal roof panel capable of spanning 3'-0" spacing and maintaining a UL 90 wind uplift rating.
  9. Provide continuous factory installed hot melt butyl sealant within the confines of the architectural standing seam metal roofing panel female rib. Loose gaskets and field applied panel sealants are unacceptable.
  10. Provide factory preformed architectural standing seam roof panels that have been tested and approved for a Class 4 Impact (Hail) resistance rating per UL 2218. Listing shall be present on the Underwriters Laboratories website.
  11. On-site, mechanically seamed or field roll formed panels are not acceptable.
- D. Thermal Movement: Provide metal roof panel assemblies that allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss. Exposed fasteners in roofing panels are not permitted.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F at material surfaces.
- E. Structural Requirements:
1. Panel structural properties determined in accordance with latest edition of American Iron and Steel Institute's "Cold Formed Steel Design Manual" using "effective width" concepts.
  2. Wind uplift design for roof assemblies shall be calculated by the architectural standing seam metal roof system manufacturer per ASTM E 1592. Calculations shall include establishment of ultimate and allowable roof system uplift capacities for both the "field" and "areas of discontinuity".
  3. Provide confirmation of positive and negative buckling moments and uplift capacity determined by full-scale testing.
- F. ENVIRONMENTAL REQUIREMENTS: Actual independent laboratory certified test results must be submitted.
1. Resistance to air infiltration: Snapseam™ – .004 cfm per linear foot of joint when tested in accordance with ASTM E 1680 at static test pressure differential of 12.00 psf.
  2. Resistance to water infiltration: Snapseam™ – No leakage through panel joints when tested in accordance with ASTM E 1646 at static test pressure differential of 6.24 psf.

## 1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, engineered and sealed shop drawings, installation instructions and certified test reports.

B. Shop Drawings:

1. Submit three (3) sets of approval / design drawings produced by the architectural standing seam metal roofing system manufacturer indicating thickness and dimensions of parts, fastening, flashing conditions, gutters, downspouts, roof curbs, gutter baffles, snow guards and anchoring methods, details and locations of seams, transitions and other provisions necessary for thermal expansion and contraction and weathertightness.
2. Indicate roof terminations, clearly showing flashings and change of direction caps.
3. Clearly indicate locations and types of field and factory applied sealants.
4. Show locations, spacing patterns and types of hold-down clips and fasteners.
5. Provide full size 24"x36" blue line or AutoCAD produced drawings provided by the architectural standing seam metal roofing system manufacturer showing a complete roof plan, roof panel layout and cross section details of every individual flashing condition for the entire roofing system. Section cut details to be minimum 1-1/2" inches per 12 inch scale.
6. Architectural drawings indicate size, profiles and dimensional requirements of architectural standing seam metal roofing panels required and are based upon the Snapseam system as manufactured by AEP-Span. Do not modify intended aesthetic effects, as judged solely by the Architect, except with Architects' written approval. Refer to Division 1 Section "Product Requirements". If modifications are proposed, submit comprehensive explanatory data to Architect a minimum of fifteen (15) days prior to the bid date for review and prior written approval. Any modifications will be put forth in a written and issued addendum.

C. Engineered Design Calculations:

1. Submit panel system manufacturer's design calculations verifying the panel system meets the design criteria specified.
2. Design calculations shall be sealed by a professional Structural Engineer employed by the manufacturer of the panel system and licensed to practice in the jurisdiction where the Project is located.

D. Samples for Initial Selection: For each type of metal roof panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Architectural Standing Seam Metal Roof Panels: 12 inches long by actual panel width. Include fasteners, clips, closures, and other metal roof panel accessories.
2. Trim and Closures: 12 inches long. Include fasteners and other accessories.
3. Accessories: 12-inch long Samples for each type of accessory.
4. A 12-by-12-inch square of roof insulation.
5. Six insulation fasteners of each type, length, and finish.
6. Submit color samples on minimum 12" x 12" metal chips for Architect's approval.

F. Certification:

1. Submit manufacturer's certification that materials and finishes meet specified requirements for air infiltration, water penetration, thermal movement, and structural performance.
2. Submit written verification of Panel Applicator's factory installation training performed by the architectural standing seam metal roofing system manufacturer and a copy of the Panel Applicator's "Authorized Applicator" certificate.

G. Maintenance Data: For metal roof panels to include in maintenance manuals.

H. Warranties: Special warranties specified in this Section.

1.06 QUALITY ASSURANCE:

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
1. Build mockup of typical roof area and eave including fascias shown on Drawings;, including attachments underlayment and accessories.
  1. Build mockups for typical roof area only, including accessories.
    - a. Size: 6 feet long by 6 feet
  2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
- B. Panel Applicator Qualifications:
1. Panel Applicator must have a minimum of five (5) years experience in the successful application of architectural structural batten standing seam metal roofing systems.
  2. Panel Applicator must be factory trained and authorized by the architectural standing seam metal roofing system manufacturer prior to the bid date in order to obtain a contract for installation.
  3. Use adequate members of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work in this Section.
  4. Use equipment of adequate size, capacity and numbers to accomplish the Work of this Section in a timely manner.
  5. Upon request, submit a minimum of five (5) successfully completed projects of similar size and scope. List project address, date of installation with Architect and Owners names and telephone numbers.
  6. The Roofing System Manufacturer will provide weekly inspections of the roofing system throughout installation. Inspection shall be conducted by an employee of the manufacturer that is not in sales nor has sales responsibility. Inspector shall be a technical inspector of the company. Weekly reports shall be copied directly to the Architect.
- C. Manufacturer's Qualifications:
1. Minimum twenty (20) years experience in the fabrication of architectural standing seam metal roofing systems on projects of similar size and scope. Upon request, submit a minimum of five (5) projects references for Architect's review. List project address, date of installation with Architect and Owners names and telephone numbers.
  2. Products listed in this specification are as manufactured by AEP-Span.
  3. No other manufacturer of architectural standing seam metal roofing systems will be accepted without prior written approval of the Architect based upon the manufacturer verifying the products can meet or exceed all specified performance criteria listed in these specifications.
  4. Requests to be listed as an approved manufacturer must be submitted in writing a minimum of fifteen (15) days prior to bid date and be accompanied by product literature, technical information, sealed Engineer's calculations verifying conformance and a product sample. Approved manufacturers will only be set forth in a written and issued addendum.
  5. No substitutions will be permitted after the bid date.
- D. Professional Engineer Qualifications:
1. Professional Structural Engineer, employed by the architectural standing seam metal roof manufacturer, who is legally qualified and licensed to practice in the jurisdiction where the Project is located.
- E. Single Source Responsibility: Provide all items of architectural standing seam metal roofing system work specified herein by a single roofing contractor to provide undivided responsibility.
- F. Pre-installation Conference:
1. Convene a pre-installation conference prior to commencing Work of this Section.

2. Attendants: Panel Applicator, installers for each component of associated work, installers of deck or substrate construction to receive roofing system work, General Contractor, Architect, Owner or Owner's Representative and architectural standing seam metal roofing manufacturer's technical representative.
3. Record discussion, decisions and agreements reached and furnish a copy to each attendant.
4. Review installation procedures and coordination required with related Work.
5. Tour representative areas of roofing substrates, inspect and discuss condition of substrates, roof drains, curbs, penetrations, wood nailers and other preparatory Work performed by other trades.
6. Review structural loading limitations of roofing substrate and inspect substrate for loss of flatness and as required for mechanical fastening.
7. Review architectural standing seam metal roofing system requirements (approved manufacturer's shop drawings, specifications and other contract documents).
8. Review required submittals.
9. Review and finalize construction schedule related to architectural standing seam metal roofing system work and verify availability of material, Panel applicator's personnel, equipment and facilities needed to avoid delays.
10. Review weather and forecasted weather conditions and procedures for coping with unfavorable weather conditions, including possibility of temporary roofing.
11. Verify locations of roof framing and roof opening dimensions by field measurements before metal roof panel fabrication and indicate measurements on manufacturer's approved Shop Drawings.
12. General Contractor to document the meeting with written minutes and copy all in attendance.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Delivery of material shall be made only after suitable facilities for its storage and protection are available at the Project site.
2. Protect products and accessories from damage and discoloration during transit and at project site.
3. Upon receipt of preformed and prefinished architectural standing seam metal roofing panels, flat sheets, flashings and panel accessories; Panel Applicator shall examine each container for damage during transit and completeness of the consignment.

B. Storage:

1. Store materials out of the weather in a clean, dry place. One end of each container should be slightly elevated and covered with a loose weatherproof covering to prevent condensation.
2. Panels and/or flashings with strippable film must not be stored in areas exposed to direct sunlight.
3. Care should be taken to prevent contact with any substance that may cause discoloration.
4. Store materials to provide ventilation and prevent bending, abrasion or twisting.
5. Do not overload roof structure with stored materials. Do not permit material storage or foot traffic on completed roof surfaces.

C. Handling:

1. Care should be taken to avoid gouging, scratching or denting.
2. Do not allow foot traffic on completed roof. If required, provide cushioned walk boards.
3. Protect installed products from damage caused by foreign objects and other trades until completion of the project.
4. Comply with pertinent provisions of Supplementary General Conditions.

1.08 WARRANTIES

- A. Substrate Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of architectural standing seam metal roofing system that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Structural failures, including rupturing, cracking, or puncturing.
    - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.



2. Warranty Period: Twenty (20) years from date of Substantial Completion.
- B. Panel Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair, refinish or replace architectural standing seam metal roofing system panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  1. Fluoropolymer (Kynar-500) Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading or color change in excess of 5 NBS units as measured per ASTM D 2244-68;
    - b. Will not Chalk in excess of a Numerical rating of 7 when measured in accordance with standard procedures specified in ASTM D 659-74;
    - c. Will not crack, peel or delaminate.
  2. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.
- C. Workmanship Warranty: Furnish a written warranty signed by the Panel Applicator guaranteeing materials and workmanship.
  1. Warranty Period: Two (2) years from date of Substantial Completion.
- D. Special Weather Tightness Warranty: Furnish architectural standing seam metal roofing system manufacturer's full system, non-prorated, no dollar limit weather tightness warranty, jointly signed by the manufacturer and Panel Applicator, agreeing to repair or replace architectural standing seam metal roofing panels or flashings that fail to remain weather tight within the specified warranty period.
  1. Warranty Period: Twenty (20) years from date of Substantial Completion.

## PART 5 - PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS:

- A. Architectural standing seam metal roofing system: AEP-SPAN or prior approved equal. Prior approval is required per Supplementary General Conditions, and alternate manufacturers must be approved per written and issued addendum a minimum of fifteen (14) days prior to the bid date.  
Approved Manufacturers, meeting the requirements of this specification, are as follows.
  1. Metal Sales Manufacturing Corp
  2. Firestone/UNA-CLAD
  3. MBCI
  4. McElroy Metal – Medallion-Lok
  5. Peterson Aluminum – Pac Clad
  6. Architectural Metal Systems
  7. Imetco
- B. BITUTHANE MEMBRANE WATERPROOF UNDERLAYMENT:.
  1. Grace "Ice and Water Shield – 40 mil.

### 2.02 MATERIALS:

- A. PANELS:
  1. Prefinished Galvalume® sheet, ASTM AZ50 made of 55% aluminum, 1.6% silicon and the balance zinc as described in ASTM specification A792.
  2. Panels shall be 24 gage with Fluoropolymer (Kynar 500) Finish.
  3. Factory fabricated panel with integral continuous overlapping seams suitable for continuous locking or crimping by mechanical means during installation. Onsite, mechanically seamed or field roll formed panel profiles will not be acceptable.
  4. Seam Size:
    - a. Male leg: 1-3/8" high, on SN-16" (Snapseam™ System).
    - b. Female leg: 1-3/4" high, on SN-16" (Snapseam™ System).
  5. Provide factory installed, high grade, hot-melt elastomeric sealant, within the confines of female seam flange, on bottom edge of female seam flange, designed to seal against adjacent male panel leg.

6. Acceptable architectural standing seam metal roofing system: SN-16" (Snapseam™ System) as manufactured by AEP Span.

B. CLIP/FASTENER ASSEMBLIES:

1. Typical clip, UL 90 requirements:
  - a. UL-90 Fasteners: as per approved manufacturer's engineered shop drawings.
  - b. UL Rated Clip: 16 gage galvanized steel hook with structural base embossments to raise the panel slightly off the substrate to reduce condensation.
  - c. Bearing Plates: minimum 4"x6" by 22 gage flat notched and slotted bearing plates for use under the clip assembly to distribute point loads and prevent indentation into the insulation.
2. Standard Fasteners: Same as UL 90 fasteners specified above.

C. ACCESSORIES: To match roof in finish.

1. Provide manufacturer's standard accessories and other items essential to completeness of architectural standing seam roof installation.
2. Roof Jacks: Manufacturer's standard EPDM with an aluminum sealing base ring; for openings twelve (12) inches or smaller.
3. Roof Curbs: fabricated to the specifications of the architectural standing seam metal roof manufacturer, thereby assuring compatibility with the roof construction framing and covering. Roof curbs shall be of sufficient size and design to coordinate with requirements for support of heat and smoke vents specified in another Division 7 Section. Roof curb flashing and framing shall provide for the expected expansion and contraction of the architectural standing seam metal roofing system.
4. Gutters and downspouts will be fabricated, and supplied by the same manufacturer, to the same gage and specification as panel.

D. FIELD SEALANTS:

1. Color coordinated primerless silicone, urethane, or high-grade, nondrying butyl as recommended and engineered by panel manufacturer.
2. Do not use sealants containing asphalt.

E. BITUTHANE MEMBRANE WATERPROOF UNDERLAYMENT:

1. Flexible, self-adhering rubberized asphalt sheet membrane with a polymeric film on the surface and a removable silicone-treated release sheet on the adhesive side
2. Bituthane membrane underlayment shall be rated for a minimum temperature resistance of up to 260 degrees F.
3. Bituthane membrane shall have a maximum permeance rating of 0.05 perms.
4. Minimum thickness shall be 40 mils.
5. Granular surfaced membranes are not acceptable.

F. POLYISOCYANURATE RIGID INSULATION:

See section 07221 for full requirements of Metal Roof Insulation. Coordinate this section with requirements.

2.03 ACCESSORIES

- A. Architectural standing seam metal roof system panel accessories: Provide components required for a complete architectural standing seam metal roofing system including, but not limited to: flashings, copings, fasciae, corner units, ridge vents and ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels, unless otherwise indicated.
1. Vents: Provide vents at ridges, fabricated of same metal as metal roof panels, with corrugated baffle insert to prevent insect infestation; equivalent to Cor-A-Vent Model V300/CS, plastic hollow core vented insert.
  2. Closures: Provide metal closures at eaves and ridges, fabricated of same metal as metal roof panels.

- B. Flashings and Trim: Formed from 0.030 thick (24 gage) thick Galvalume (tm) aluminum-zinc alloy coated steel sheet prefinished by coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Flashings and Trims shall be the same finish, gage and color as the specified roofing system.
- C. Gutters: Formed from 0.030" (22 gage) thick Galvalume (tm) aluminum-zinc alloy coated steel sheet prefinished by coil coating, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch long sections, sized according to SMACNA's "Architectural Sheet Metal Manual." Furnish flat stock gutter straps and brackets spaced 30 inches on center, fabricated from same metal as gutters 3/16" x 1 1/2". Provide steel or aluminum wire ball strainers at outlets. Gutters shall be the same finish, gage and color as the specified roofing system.
- D. Downspouts: Formed from 0.030" (22 gage) thick Galvalume (tm) aluminum-zinc alloy coated steel sheet prefinished by coil coating; in minimum 10-foot long sections, complete with formed elbows and offsets. Downspouts shall be the same finish, gage and color as the specified roof system. Furnish with 3/16" x 1 1/2" metal hangers to march gutters. Fabricate seams using flat stock seams meeting SMACNA.
- E. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

## 2.04 FABRICATION

- A. Panels:
  - 1. Provide factory formed panel widths of 16", with a 1-3/4" high architectural standing seam panels.
  - 2. On-site or field roll formed panels are not acceptable.
  - 3. Provide panels in full length from ridge to eave.
  - 4. Roof panels shall have flush horizontal and vertical surfaces to facilitate sealing at terminations. Panel configurations that create voids and require supplemental closure devices are acceptable.
- B. Seams:
  - 1. Panel seams shall interlock along entire length of seam.
  - 2. Design seams to lock up and resist joint disengagement during design wind uplift conditions as calculated to comply with local building codes and design uplift criteria.
  - 3. Provide factory sealant within confines on trailing edge of female seam leg to aid in resistance of leaks and provide panel-to-panel seal while allowing expansion and contraction movement, and the seams shall be continuously locked together during installation without the use of field seaming machinery.
- C. Clips:
  - 1. Provide UL listed clip designed to allow panels to thermally expand and contract and provide a minimum of  $\pm 1$  inch of thermal movement. Clip shall incorporate a self-centering feature to allow a minimum of 1" of movement in both directions along panel length.
  - 2. Clip shall be designed to meet positive and negative pressures as calculated per local building code and as engineered by the roofing system manufacturer.
- D. Expansion and Contraction:
  - 1. Engineer panels to use concealed anchors that permit expansion and contraction, except at end laps, ridges and hips.
- E. Trim/Flashings:
  - 1. Prefinished sheet metal designed and supplied by the architectural standing seam metal roof system manufacturer in the same gage, material and finish as the architectural standing seam metal roofing system.
  - 2. Locations, design, sealing and fastening methods as per the manufacturer's approved engineered shop drawings.
  - 3. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

4. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
  - a. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

2.05 FINISH:

- A. Fluorocarbon Coating:
  1. Full strength 70% Kynar 500® coating baked on for 15 minutes at 450 degrees F to dry-film thickness of 1.0 mil.
  2. 15% reflective gloss (ASTM D 523). (Low Gloss).
  3. 0.3 mil baked on epoxy primer.
  4. Color: Custom - To match existing roof.

PART 3 - EXECUTION

3.01 CONNECTING WORK:

- A. General: Provide metal roofing panels of full length from eave to ridge when possible.
  1. Field cutting by torch is not permitted.
  2. Do not apply roofing during inclement weather.
  3. Do not apply roofing to damp or frozen deck surface.
  4. Do not expose materials vulnerable to water, wind or sun damage in quantities greater than can be weatherproofed during the same day.
  5. Rigidly fasten Ridge of metal roof panels and allow free eave movement due to thermal expansion and contraction per the approved shop drawings.
  6. Install screws fasteners with power tools having controlled torque.
  7. Locate and space fasteners per approved shop drawings in true vertical and horizontal alignment.
  8. Install Ridge, Hip and penetration flashings per the approved shop drawings as work progresses.
  9. Position roof jacks only in the flat of the panel; do not alter or impede standing seam ribs.
- B. The Panel Applicator shall examine all surfaces on which their work is to be applied, and shall notify the architect in writing if not suitable to receive their work. Work on any surface shall constitute acceptance of this surface by the Panel Applicator. After beginning installation, install approximately 500 square feet of panels for Architect's approval, before proceeding with substantial work.

3.02 FIELD MEASUREMENTS:

- A. Panel Applicator must take field measurements to verify or supplement dimensions indicated prior to fabrication of any materials. Where field measurements cannot be made without delaying the work, either establish opening dimensions and proceed with fabricating panels without field measurements or allow for trimming panel units.

3.03 RIGID BOARD INSULATION INSTALLATION:

- A. Comply with system manufacturer's written instructions for installing roof insulation.
  1. Install one (1) layer of insulation under area of roofing in required thickness to achieve specified 'R' value. Install insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding ¼ inch with insulation.
  2. Attach insulation to deck as recommended by the insulation manufacturer in the required pattern to achieve a UL-90 wind uplift rated assembly.
  3. Use UL rated fasteners as recommended by the insulation manufacturer.
  4. Seal all joints in top layer of insulation with sealing tape.
  5. Apply no more insulation than can be covered in the same workday.

3.04 ACCESSORY INSTALLATION

- A. Waterproof Underlayment Installation: Apply waterproof underlayment over entire roof surface perpendicular to metal roofing panels and over parapet blocking per manufacturer's written instructions, but with not less than six (6) inch laps at vertical (side) laps and four (4) inch horizontal (top and bottom) laps.
- B. Hanging Gutters: Join sections with riveted and soldered or lapped and sealed joints with elastomeric sealant. Allow for thermal movement. Attach gutters at eave or fascia to firmly anchored gutter brackets spaced not more than 30 inches apart. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
  - a. Fasten gutter straps to front and back of gutter at 30" o.c. spaced alternately with brackets.
  - b. Loosely lock straps to front gutter bead and anchor to roof deck.
  - c. Install gutter with expansion joints at locations not to exceed 50' and at roof expansion joints.
  - d. Provide gutter baffles at valleys.

3.05 METAL ROOFING INSTALLATION, GENERAL:

- A. Workmanship shall conform to standards set forth in the architectural sheet metal manual as published by SMACNA.
- B. Comply with manufacturer's instructions for assembly, installation, and erection in order to achieve a weather tight installation. Install in accordance with approved shop drawings.
  - 1. Anchor securely in place using clips and fasteners spaced in accordance with manufacturer's recommendations for design wind load criteria.
  - 2. Panels should be installed in such a manner that horizontal lines are true and level and vertical lines are plumb.
  - 3. Field apply sealant to penetrations, transitions, and other locations as necessary (not inside the standing seam ribs) for an airtight, waterproof installation.
  - 4. Remove all protective film, if any, before installation of materials.
- C. Dissimilar Metals: Do not allow panels or flashings to come into contact with dissimilar metals.

3.06 CLEAN UP:

- A. Clean exposed surfaces of work promptly after completion of installation.
- B. Only minor scratches and abrasions will be allowed to be touched up. Any other damaged material shall be replaced.
- C. Leave work areas clean, free from grease, dirt, finger marks, stains and stains.
- D. Remove scrap and debris from surrounding grounds and work areas daily.

3.07 PROTECTION:

- A. Metal Roofing: Protect work as required to ensure that structural standing seam metal roof system will be without damage at time of final completion.
- B. Rigid Insulation: Cover insulation as soon as possible with specified underlayment for protection against excessive moisture prior to roofing application.

END OF SECTION

**SECTION 07415 - PREFORMED (Prefinished) METAL SOFFIT / WALL PANEL SYSTEM**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. Work Included: The contractor shall provide all material, labor, and administration and other items to provide a complete prefinished preformed metal soffit / wall panel system complying with performance requirements indicated and capable of withstanding structural movement, thermally induced movement and exposure to weather.
- B. Coordinate preformed metal soffit / wall panel system substructure framing work.
- C. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary General Conditions, and Sections in Division 1 of these Specifications.
- D. One Manufacturer shall provide all work associated this section and Section 07411 - Architectural Metal Roof Panels

**1.2 SECTION INCLUDES:**

- A. Preformed and prefinished manufacturer's fully engineered preformed metal soffit / wall panel system with continuous interlocking seams, light gage framing supports and concealed fastening devices.
- B. Color coordinated metal closures, splice plates, miscellaneous flashings and attachment devices.
- C. Provide concealed fasteners, closures and sealants as necessary to meet design criteria.
- D. Light gage steel sub-framing.

**1.3 RELATED SECTIONS:**

- A. Division 5 Section "Structural Steel" for structural steel framing.
- B. Division 6 Section "Rough Carpentry" for nailers and miscellaneous blocking.

**1.4 SYSTEM DESCRIPTION:**

**A. DESIGN REQUIREMENTS:**

- 1. The factory preformed metal soffit / wall panel system, including: panels, flashings, light gage steel sub- framing and attachment accessories and screws shall be designed by the metal soffit / wall system manufacturer per ASTM E 72 (chamber) testing to meet the local building code. The design criteria shall include the following:
  - a. Listing of applicable loads.
  - b. Listing of the building importance factor (life safety factor).
  - c. Design wind speed.
  - d. Building exposure factor.
  - e. Other necessary criteria.
- 2. The preformed metal soffit / wall panel system manufacturer shall provide an engineered analysis of the soffit / wall system, sealed by a registered Structural Engineer employed by the manufacturer and licensed in the State of Texas, verifying that the product and attachment methods will resist wind pressures imposed upon it pursuant to the applicable building codes and that the soffit / wall system fully complies with all specified requirements.
- 3. Provide factory preformed soffit / wall panel system that has been pretested and certified by manufacturer to comply with specified requirements under installed conditions.
- 4. Provide one piece, single length preformed metal soffit / wall panels.
- 5. Provide continuous interlocking seams with open hem male legs that inherently increase load span capability, stiffness and flexural stress handling.

6. [Wall Systems Only:] Provide continuous field installed butyl sealant within the panel seams.
7. Provide factory-preformed panel that has been tested and approved for a Class 4 Impact (Hail) resistance rating per UL 2218. Listing shall be present on the UL website (Refer to Underwriters Laboratories website at [www.ul.com](http://www.ul.com))
8. On-site, press-broken or field rollformed panels are not acceptable.

B. STRUCTURAL REQUIREMENTS:

1. Panel structural properties determined in accordance with latest edition of American Iron and Steel Institute's "Cold Formed Steel Design Manual," using "effective width" concepts.
2. Wind pressure design for preformed metal soffit / wall panel systems shall be calculated by the metal soffit / wall panel system manufacturer per ASTM E 72 (chamber) test method. Calculations shall include establishment of ultimate and allowable soffit / wall panel system span capacities for both the "field" and "areas of discontinuity".
3. Provide confirmation of positive and negative buckling moments and span capacity determined by full-scale tests.

C. SUBSTRATE CRITERIA:

1. Factory Preformed Soffit / Wall Panels: Manufacturer's fully engineered factory preformed metal soffit / wall panel system installed over light gage steel framing that is capable of withstanding design criteria specified in Section A.1 above.
2. Light Gage Steel Framing: Provide light gage steel framing designed and supplied by the preformed metal soffit / wall panel system manufacturer, capable of withstanding the design criteria specified in Section A.1 above and spaced as shown on the approved shop drawings. Fastening pattern for light gage framing shall be per system manufacturer's design using noncorrosive fasteners.

1.5 SUBMITTALS:

A. PRODUCT DATA: Submit manufacturer's specifications, engineered detail drawings, and installation instructions.

B. SHOP DRAWINGS:

1. Submit three (3) sets of approval design drawings produced by the preformed metal soffit / wall panel system manufacturer indicating thickness and dimensions of parts, fastenings and anchoring methods, details and locations of seams, transitions, framing and other provisions necessary for thermal expansion and contraction.
2. Indicate soffit / wall panel terminations, clearly showing flashings and closure methods.
3. Clearly indicate locations of field and factory applied sealants.
4. Show locations, spacing patterns and types of hold-down fasteners.
5. Provide 24" x 36" blue line or Auto CAD produced drawings provided by the preformed metal soffit / wall system manufacturer showing complete reflected roof, soffit, plan, wall elevation plans, wall panel layout, and cross section details for every individual condition of the entire soffit / wall panel system.

C. SAMPLES:

1. Submit two samples, 12" long x full width of panel, showing proposed metal gauge and seam profile.
2. Submit color samples on metal for Architect's selection from manufacturer's standard color offering. Color and finish must match the architectural metal roof panels.

D. TEST REPORTS:

1. Submit certified test reports confirming ASTM E 72 (chamber method) testing.

E. ENGINEERED DESIGN CALCULATIONS:

1. Submit preformed metal soffit / wall panel system manufacturer's design calculations verifying the panel system meets the specified building code as defined in Section A.1 Design Requirements listed above.
2. Design calculations shall be sealed by a registered Structural Engineer employed by the manufacturer of the preformed metal soffit / wall panel system that is licensed in the State of Georgia.

F. CERTIFICATION:

1. Submit manufacturer's certification that materials and finishes meet specified requirements.
2. Submit written verification of panel Applicator's factory installation training performed by the preformed metal soffit / wall panel system manufacturer and a copy of the Panel Applicator's "Authorized Applicator" certificate.

1.6 QUALITY ASSURANCE:

A. MANUFACTURER'S QUALIFICATIONS:

1. Minimum twenty (20) years experience in the fabrication of preformed metal soffit / wall panel systems on projects of similar size and scope. Upon request, submit a minimum of five (5) project references for Architect's review. List project address, date of installation, Architects and Owner's name and telephone numbers.
2. Requests to be listed as an approved manufacturer must be submitted in writing a minimum fifteen (15) days prior to bid date accompanied by product literature, technical information, sealed engineer's calculations verifying conformance, and a product sample. Approved manufacturers will only be set forth in a written and issued addendum.
3. No substitutions will be permitted after the bid date.

B. APPLICATOR QUALIFICATIONS:

1. Panel Applicator must have a minimum of five (5) years experience in the application of preformed metal soffit / wall panel systems.
2. Panel Applicator must be factory trained and approved by the preformed metal soffit / wall panel system manufacturer prior to the bid date in order to obtain a contract for installation.
2. Use adequate members of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work in this Section.
4. Use equipment of adequate size, capacity and numbers to accomplish the work of this Section in a timely manner.
5. Upon request, submit a minimum of five (5) successfully completed projects of similar size and scope. List project address, date of installation, Architect and Owner's name and telephone numbers.
6. Single Source Responsibility: Provide all items of preformed metal soffit / wall panel system work specified herein by a single contractor to provide undivided responsibility.

C. REGULATORY REQUIREMENTS:



1. Comply with all requirements of applicable building codes and other agencies having jurisdiction for positive and negative design loads of preformed metal soffit / wall panel systems.
2. Preformed metal soffit / wall panel system shall be previously tested per ASTM E 72.

#### 1.7 DELIVERY, STORAGE AND HANDLING:

##### A. DELIVERY:

1. Delivery of material shall be made only after suitable facilities for its storage and protection area available on the site.
2. Protect products and accessories from damage and discoloration during transit and at project site.
3. Upon receipt of prefinished preformed metal soffit / wall panels, flatsheets, flashings and panel accessories, Panel Applicator shall examine each container for damage and for completeness of the consignment.

##### B. STORAGE:

1. Protect products and accessories from damage and discoloration during transit and at project site. Store materials out of the weather in a clean, dry place. One end of each container should be slightly elevated and covered with a loose weatherproof covering to prevent condensation.
2. Panels and/or flashings with strippable film must not be stored in areas exposed to direct sunlight. Remove strippable film before installation.
3. Store materials to provide ventilation and prevent bending, abrasion or twisting.
4. Do not overload roof structure with stored materials. Do not permit material storage or traffic on completed roof surfaces.

##### C. HANDLING:

1. Care should be taken to avoid gouging, scratching or denting.
2. Do not allow traffic on completed roof. If required, provide cushioned walk boards.
3. Protect installed products from damage caused by foreign objects and construction until completion of project.
4. Comply with pertinent provisions of Supplementary General Conditions.

#### 1.8 WARRANTY:

##### A. Furnish manufacturer's standard 20-year written finish warranty stating that architectural fluorocarbon finish will be:

1. Free from fading or color change in excess of 5 NBS units as measured per ASTM 2244-68;
2. Will not chalk in excess of a numerical rating of 7 when measured in accordance with standard procedures specified in ASTM D 659-74;
3. Will not peel, crack, chip or delaminate

##### B. Furnish a written warranty signed by the Panel Applicator for a two-year period from the date of substantial completion of the building guaranteeing materials and workmanship for the preformed metal wall panel system, flashings and penetrations.

#### 1.9 PRE-INSTALLATION CONFERENCE:

- A. Convene prior to commencing work of this Section.
- B. Attendants: Panel Applicator, installer of each component of associated work, installers of deck or substrate construction to receive soffit / wall panel work, Architect, Owner or Owner's Representative, soffit / wall panel system manufacturer's technical representative and General Contractor.
- C. Record discussion, decisions and agreements reached and furnish a copy to each attendant.

- D. Review installation procedures and coordination required with related Work.
- E. Tour representative areas of soffit / wall panel system substrates, inspect and discuss condition of substrates, penetrations, wood nailers and other preparatory work performed by other trades.
- F. Review structural loading limitations of primary structure and inspect work areas for loss of flatness and as required for mechanical fastening.
- G. Review soffit / wall panel system requirements, approved manufacturer's shop drawings, specifications and other contract documents.
- H. Review required submittals.
- I. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to avoid delays.
- J. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing.
- K. Contractor to document the meeting with written minutes and copy all in attendance.

## PART 2 –PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS:

See Section 07411 - Architectural Metal Roof Panels – one manufacturer – installer is required for both systems.

- A. LIGHT GAGE FRAMING SUBSTRATE: Light gage framing members, minimum 16 gage, designed and spaced per preformed metal soffit / wall panel system manufacturer's approved shop drawings.

### 2.2 MATERIALS:

#### A. PANELS:

- 1. Prefinished Galvalume® sheet, ASTM AZ55 made of 55% aluminum, 1.6% silicon and the balance zinc as described in ASTM specification A792.
- 2. Panels shall be 22 gauge (0.030" thick) with Kynar 500 Finish.
- 3. Factory prefabricated preformed soffit / wall panel with interlocking seams with open hem male legs suitable for continuous engagement during installation. Onsite, press-broken or field rollformed soffit / wall panel profiles will not be acceptable.
- 4. Panel Dimensions:
  - a. Panel Width: 12" on FP-12" (Flush Panel™).
  - b. Rib Height: Nominal 1" high on FP-12" (Flush Panel™).
- 5. Interior Panel Stiffening Ribs:
  - a. FP12"-0: Flat, smooth appearance, no interior pencil grooves.
- 6. Acceptable Preformed Metal Soffit / Wall Panel System: FP-12" (Flush Panel™) or approved equal.

#### B. FASTENER ASSEMBLIES:

- 1. Typical Soffit / Wall Panel Fasteners:
  - a. Manufacturer's engineered #10-16x1" long self-drilling, self-tapping pancake head Phillips drive screws in a noncorrosive base material for metal-to-metal applications.
  - b. Fastener spacing to be per approved engineered shop drawings to resist system load requirements. Exposed fasteners in soffit / wall panels will not be permitted.
- 2. Light Gage Framing Fasteners:
  - a. #12-14x1" long self-drilling, self-tapping 516" hex head Tek screws in a noncorrosive base material for metal-to-metal applications.

- b. Fastener spacings to be per the manufacturer's approved engineered shop drawings for size, location and pull-out strength to resist system load requirements.
- C. ACCESSORIES:
  1. Provide manufacturer's standard accessories and other items essential to completeness of preformed metal soffit / wall panel system installation including flashing anchor cleats, trims, metal closures and miscellaneous flashings. Flashings to be factory formed from the same gage and finish as the preformed metal soffit / wall panels unless specifically noted otherwise.
- D. FIELD SEALANTS:
  1. Color coordinated primerless silicone, urethane, or high-grade, nondrying butyl as recommended and engineered by panel manufacturer.
  2. Do not use sealants containing asphalt.
- E. LIGHT GAGE STEEL FRAMING:
  1. Provide light gage steel framing designed and supplied by the preformed metal soffit / wall panel system manufacturer.
  2. Size, spacing and attachment of light gage steel framing to be per the preformed metal soffit / wall panel system manufacturer's approved shop drawings and capable of withstanding the design criteria specified in Section A.1 above.

## 2.3 FABRICATION:

- A. Panels:
  1. Provide factory formed panel widths of 12", with a nominal 1" deep rib height.
  2. On-site, press-broken or field rollformed panels are not acceptable.
  3. Provide panels in full length wherever possible, not to exceed 30'-0" in length.
  4. Where single length panels are not practical provide an engineered flush lap joint.
  5. Wall soffit / panels shall have flush horizontal and vertical surfaces to facilitate sealing at terminations. Panel configurations that create voids and require supplemental closure devices are unacceptable.
- B. Panel Ribs:
  1. Provide panel ribs that continuously interlock along entire length of rib with open hem male legs and without the use of field seaming machines. Button punched, riveted or soldered seams are unacceptable.
  2. Vinyl gaskets inside female ribs are not acceptable.
- C. Panel Fasteners:
  1. Provide manufacturer's engineered #10-16x1" long, self-drilling, self-tapping pancake head Phillips drive screws in a noncorrosive base material.
  2. Fastener spacing to be as per the manufacturer's approved engineered shop drawings for size, location and pull-out strength to resist system load requirements.
  3. Exposed fasteners in wall panels are unacceptable.
- D. Light Gage Steel Framing:

- a. Supply and install light gage framing as designed and supplied by the manufacturer of the preformed metal soffit / wall panel system. Install in accordance with manufacturer's approved engineered shop drawings.
- E. Trim Flashings:
  - a. Prefinished sheet metal designed and supplied by the manufacturer in the same gauge, material and finish as the preformed metal soffit / wall panel system.
  - b. Locations, design, sealing and fastening methods as per the manufacturer's approved engineered shop drawings.

## 2.4 FINISH:

Match Section 07411 - Architectural Metal Roof Panels

## PART 3 - EXECUTION

### 3.1 CONNECTING WORK:

- A. General: Provide metal roofing panels of full length from eave to ridge when possible.
  - 1. Field cutting by torch is not permitted.
  - 2. Do not apply soffit / wall panels during inclement weather.
  - 3. Do not apply soffit / wall panels to damp or frozen surfaces.
  - 4. Do not expose materials vulnerable to water, wind or sun damage in quantities greater than can be weatherproofed during the same day.
  - 5. Install screws fasteners with power tools having controlled torque.
  - 6. Locate and space fasteners per the approved shop drawings in true vertical and horizontal alignment.
  - 7. Install flashings per the manufacturer's approved engineered shop drawings as work progresses. Cut penetrations in the flat of the panel, do not alter panel ribs.
- B. The Panel Applicator shall examine all surfaces on which their work is to be applied, and shall notify the architect in writing if not suitable to receive their work. Work on any surface shall constitute acceptance of this surface by the Panel Applicator. After beginning installation, install approximately 500 square feet of panels for Architect's approval, before proceeding with substantial work.
- C. Wood Members, Units: Comply with requirements of Division 6 Wood Blocking of these specifications for nailers and other wood members indicated as soffit / wall panel system work. Provide wood pressure treated with water-borne preservatives for above ground use. All nailers shall be anchored sufficiently to resist a force of 75 pounds per linear foot in any direction. Provide nailers at all locations required by the roofing manufacturer (whether shown or not) – verify conditions prior to commencement of roofing installation.

### 3.2 FIELD MEASUREMENTS:

- A. Panel Applicator must take field measurements to verify or supplement dimensions indicated prior to fabrication of any materials. Where field measurements cannot be made without delaying the work, either establish opening dimensions and proceed with fabricating panels without field measurements or allow for trimming panel units.

### 3.3 LIGHT GAGE STEEL FRAMING INSTALLATION:

- A. Comply with system manufacturer's written instructions for installing light gage steel framing.

1. Install framing per manufacturer's approved engineered shop drawings for size, spacing and attachment of all members.
2. Cover light gage steel framing as soon as possible for protection against excessive moisture prior to preformed metal soffit / wall panel application.
3. Do not install light gage steel framing in adverse weather conditions. Light gage steel framing that is damaged, bent or twisted will be rejected.

### 3.6 PREFORMED METAL SOFFIT / WALL INSTALLATION:

- A. Workmanship shall conform to standards set forth in the architectural sheet metal manual as published by SMACNA.
- B. Comply with manufacturer's instructions for assembly, installation, and erection. Install in accordance with approved shop drawings.
  1. Anchor preformed metal soffit / wall panels securely in place using fasteners spaced in accordance with manufacturer's recommendations for design load criteria.
  2. Panels should be installed in such a manner that horizontal lines are true and level and vertical lines are plumb.
  3. Field apply sealant to penetrations, transitions, and other locations as necessary per the manufacturer's approved engineered shop drawings.
  4. Remove all protective film, if any, before installation of materials.
- C. Dissimilar Metals:
  1. Do not allow panels or flashings to come into contact with dissimilar metals.

### 3.7 CLEAN UP:

- A. Clean exposed surfaces of work promptly after completion of installation.
- B. Only minor scratches and abrasions will be allowed to be touched up. Any other damaged material shall be replaced.
- C. Leave work areas clean, free from grease, dirt, finger marks, stains and stains.
- D. Remove scrap and debris from surrounding grounds and work areas daily.

### 3.8 PROTECTION:

- A. Preformed Metal Soffit / Wall Panels: Protect work as required to ensure that preformed metal soffit / wall panel system will be without damage at time of final completion.
- B. Light Gage Steel Framing: Cover light gage steel framing as soon as possible for protection against excessive moisture prior to preformed metal soffit / wall panel system application.

END OF SECTION

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.
- E. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.

#### 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](http://www.JM.com).
- F. Guarantees: Provide manufacturer's current guarantee specimen.
- G. Prior to beginning the work of this section, roofing sub-contractor shall provide a copy of the final System Assembly Letter issued by the manufacturer indicating that the products and system to be installed shall be eligible to receive the specified manufacturer's guarantee when installed by a certified installer in accordance with the application requirements, inspected and approved by a Manufacturer's Technical Representative.
- H. Prior to roofing system installation, roofing sub-contractor shall provide a copy of the Guarantee Application Confirmation document issued by the manufacturer indicating that the project has been reviewed for eligibility to receive the specified guarantee and registered.

#### 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.
- 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.

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.
- C. Existing Guarantees: Guarantees on existing building elements should not be affected by scope of work.
  - 1. Installer is responsible for coordinating with building owner's representative to verify compliance.

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 or Firestone. Other manufacturers are encouraged to submit a substitution request per section 00020.
  - 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 membrane, and solvent-based bonding adhesive for base flashings. Basis of Design: JM Membrane Bonding Adhesive (TPO&EPDM)
- 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

- 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 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.

3.4 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. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.
- D. 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.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 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.

### 3.6 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.

### 3.7 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.

### 3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.
- B. 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.

3.9 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 07620 - SHEET METAL FLASHING AND TRIM

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Manufactured reglets with counterflashing.
2. Formed roof-drainage sheet metal fabrications.
3. Formed low-slope roof sheet metal fabrications.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Distinguish between shop- and field-assembled work.
3. Include identification of finish for each item.
4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.

C. Samples: For each exposed product and for each color and texture specified.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

C. Sample warranty.

#### 1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

#### 1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1. For copings and roof edge flashings that are SPRI ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.
- B. Mockups: Build mockups to verify selections made under Sample submittals to demonstrate aesthetic effects and to set quality standards for fabrication and installation.

## 1.6 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
  1. Finish Warranty Period: 20 years from date of Final Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's The NRCA Roofing Manual requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1, meeting all applicable codes and capable of resisting the following design pressure:
  1. Design Pressure: Per current building codes.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  1. Temperature Change: 120 deg F (67 deg C), ambient; material surfaces.

### 2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Metallic-Coated Steel Sheet: Provide aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 prepainted by coil-coating process to comply with ASTM A 755/A 755M.
  1. Exposed Coil-Coated Finish:
    - A. Finish and color to match 07411 Arch Metal Roof Panels.



## 2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Carlisle Coatings & Waterproofing Inc.
    - b. Protecto Wrap Company.
    - c. SDP Advanced Polymer Products Inc.
  - 2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C) or higher.
  - 3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C) or lower.

## 2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
  - 1. General: Blind fasteners
    - a. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
  - 2. Fasteners for Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

## 2.5 MANUFACTURED REGLETS

- A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-

mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.

1. Material: Galvanized steel, 0.022 inch (0.56 mm) thick.
2. Finish: Match 07411 Arch Metal Roof Panels

## 2.6 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
  1. Obtain field measurements for accurate fit before shop fabrication.
  2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
  3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
  1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
  2. Use lapped expansion joints only where indicated on Drawings.
- C. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- F. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

## 2.7 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- long sections. Furnish flat-stock gutter brackets and gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters. Shop fabricated. Gutters to match 07411 Arch Metal Roof Panels.
- B. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.

1. Hanger Style: Straps with concealed flat seam and concealed fasteners
2. Fabricate from the following materials:
  - a. Aluminum-Zinc Alloy-Coated Steel: 22 ga. Match 07411 Arch Metal Roof Panels

- C. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch- wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fabricate from the following materials:
1. Aluminum-Zinc Alloy-Coated Steel: 22 ga thick.

## 2.8 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing Gravel Stop and Fascia Cap: Fabricate in minimum 96-inch long, but not exceeding 12-foot long sections. Furnish with 6-inch wide, joint cover plates. Shop fabricate interior and exterior corners.
1. Fabricate from the Following Materials:
    - a. Aluminum-Zinc Alloy-Coated Steel: 22 ga thick.
    - b. Finish and color to match 07411 Arch Metal Roof Panels
- B. Copings: Fabricate in minimum 96-inch long, but not exceeding 12-foot long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners. Flat seam, no exposed fasteners.
1. Fabricate from the Following Materials:
    - a. Aluminum-Zinc Alloy-Coated Steel: 22 ga thick. Finish to match 07411 Arch Metal Roof Panels
- C. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Aluminum-Zinc Alloy-Coated Steel: 24 ga thick.
- D. Counterflashing and Flashing Receivers: Fabricate from the following materials:
1. Aluminum-Zinc Alloy-Coated Steel: 24 ga thick.

## PART 3 - EXECUTION

### 3.1 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.

### 3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
  - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
  - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
  - 3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
  - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
  - 5. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
  - 1. Coat concealed side of sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
  - 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
  - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
  - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws, not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 07900 "Joint Sealants."
- G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

### 3.3 ROOF-DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Hanging Gutters: Join sections with riveted joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.
  - 1. Install gutter with expansion joints at locations not exceeding, 50 feet apart. Install expansion-joint caps.
- C. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c.
- D. Parapet Scuppers: Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
- E. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints minimum of 4 inches (100 mm) in direction of water flow.

### 3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints minimum of 4 inches (100 mm).

### 3.5 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of

wall flashing with installation of wall-opening components such as windows, doors, and louvers.

- B. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 04200 Unit Masonry.

### 3.6 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 07620

**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.
    - i. 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. Pecora Corporation; Dynatrol I.
    - b. Sherwin Williams – LOXON 1K smooth (S1)
    - c. Tremco; DyMonic.
    - d. BASF – NP1
  - 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 Nonsag Pick-Resistant Urethane Sealant **ES-4**:
- 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-3**.
  - 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-3**.
  - 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-3**.
  - 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-3**.
  - 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-3**.
  - 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-3**.
  - 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 CMU comers on interior walls.

1. Joint Sealant: Multicomponent nonsag pick resistant urethane sealant **ES-3**.
  2. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match color of adjacent materials.
- I. Joint-Sealant Application JS-I0: Interior perimeter joints of openings.
1. Joint Sealant: Single-component non sag urethane sealant **ES-3**.
  2. Joint-Sealant Color: As selected by Architect. from manufacturer's full range to match color of adjacent materials.
- J. 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-3**
  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.

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 (FRP)**

**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. Manufacture 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 according 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 08211 - FLUSH WOOD DOORS**

**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 Flush Wood Doors. 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 the following:
  - 1. Solid-core doors with wood-veneer faces.
  - 2. Factory finishing flush wood doors.
  - 3. Factory fitting flush wood doors to frames and factory machining for hardware.

**1.3 SUBMITTALS**

- A. Product Data: For each type of door. Include details of core and edge construction, trim for openings, and louvers.
  - 1. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
  - 1. Indicate dimensions and locations of mortises and holes for hardware.
  - 2. Indicate dimensions and locations of cutouts.
  - 3. Indicate requirements for veneer matching.
  - 4. Indicate doors to be factory finished and finish requirements.
  - 5. Indicate fire ratings for fire doors.
- C. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:
  - 1. Faces of factory-finished doors with transparent finish. Show the full range of colors available for stained finishes.

**1.4 QUALITY ASSURANCE**

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.
- B. Quality Standard: Comply with the following standard:
  - 1. AWI Quality Standard: AWI's "Architectural Woodwork Quality Standards" for grade of door, core, construction, finish, and other requirements.
- C. Fire-Rated Wood Doors: Doors 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.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Mark each door with individual opening numbers used on Shop Drawings. Use removable tags or concealed markings.

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during the remainder of the construction period to comply with requirements of the referenced quality standard for Project's geographical location. Temperature must be maintained between 65 and 78 degrees.

#### 1.7 WARRANTY

- A. General Warranty: Door manufacturer's warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form, signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup, or twist) more than 1/4 inch (6.35 mm) in a 42-by-84-inch (1067-by-2134-mm) section or that show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 75-mm) span, or do not comply with tolerances in referenced quality standard.
  - 1. Warranty shall be in effect during the following period of time after the date of Substantial Completion:
    - a. Solid-Core Interior Doors: Life of installation.

### 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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Flush Wood Doors:
    - a. Algoma Hardwoods Inc.
    - b. Ampco Products, Inc.
    - c. Buell Door Co.
    - d. Chappell Door Co.
    - e. Eagle Plywood & Door Manufacturing, Inc.
    - g. Graham Assa Abloy Group Company
    - h. Haley Brothers, Inc.
    - i. Ideal Architectural Doors & Plywood
    - j. Marlite.
    - k. Mohawk Flush Doors, Inc.

- l. Poncraft Door Co.
  - m. Vancouver Door Company, Inc.
2. Metal Louvers for Doors:
  - a. Air Louvers, Inc.
  - b. L & L Louvers, Inc.
  - c. LL Building Products, Inc.; a division of GAF Materials Corporation.

## 2.2 DOOR CONSTRUCTION, GENERAL

- A. Doors for Transparent Finish: Comply with the following requirements:
1. Premium Grade A Rotary Cut white birch.
  2. Match between Veneer Leaves: Book Match.
  3. Match within Door Faces: Balance Match.
  4. Pair and Set Match: Provide for pairs of doors and for doors hung in adjacent sets.
    - a. Comply with requirements in Division 6 Section "Interior Architectural Woodwork."
  5. Stiles: Same species as face or a compatible species.

## 2.3 SOLID-CORE DOORS

- A. Particleboard Cores: Comply with the following requirements:
1. Particleboard: ANSI A208.1, Grade LD-1.
  2. Construction: Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.
- B. Interior Veneer-Faced Doors: Comply with the following requirements:
1. Core: Particleboard core.
  2. Construction: Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.
- C. Fire-Rated Doors: Comply with the following requirements:
1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as required to provide fire rating indicated.
  3. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated.
  4. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.
  4. Pairs: Furnish formed-steel edges and astragals for pairs of fire-rated doors, unless otherwise indicated.
  5. Pairs: Provide fire-rated pairs with fire-retardant stiles that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals.

## 2.4 LOUVERS AND LITE FRAMES

- A. Metal Frames for Lite Openings in all Doors: Manufacturer's standard frame formed of 0.0478-inch- (1.2-mm-) thick, cold-rolled steel sheet, factory primed and approved for use in doors of fire rating indicated.

## 2.5 FABRICATION

- A. Fabricate flush wood doors in sizes indicated for Project site fitting.
- B. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
  - 1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements of NFPA 80 for fire-rated doors.
- C. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
  - 1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
  - 2. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- D. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
  - 1. Lite Openings: Trim openings with moldings of material and profile indicated.

## 2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard's requirements for factory finishing.
- B. Finish wood doors at factory. Doors to be finished on all sides.
- C. Transparent Finish: Comply with requirements indicated for grade, finish system, staining effect, and sheen.
  - 1. Grade: Custom.
  - 2. Finish: AWI System TR-4 conversion varnish.
  - 3. Finish: Manufacturer's standard finish with performance requirements comparable to AWI System TR-4 conversion varnish.
  - 4. Staining: Match approved sample for color.
  - 5. Effect: Open-grain finish.
  - 6. Sheen: Semigloss.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine installed door frames before hanging doors.
  - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
  - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Hardware: For installation, see Division 8 Section "Door Hardware."

- B. Manufacturer's Written Instructions: Install wood doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
  - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation, if fitting or machining is required at Project site.

### 3.3 ADJUSTING AND PROTECTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Refinish or replace doors damaged during installation.
- C. Protect doors as recommended by door manufacturer to ensure that wood doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 08211

**SECTION 08411 - 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: Architectural Aluminum Storefront Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront units.
  - 1. Basis of design: 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. Other manufacturers subject to the requirements of this specification:
      - 1) EFCO Corporation
      - 2) Old Castle
      - 3) YKK
- 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<sup>2</sup> (0.3 l/s · m<sup>2</sup>) 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.  $U = 0.39 \text{ BTU/hr/ft}^2/\text{°F}$ .
5. Solar Heat Gain Coefficient (SHGC): Provide aluminum windows with a whole-window SHGC maximum of 0.38
5. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than:
  - a.  $68_{\text{frame}}$  and  $68_{\text{glass}}$  (low-e).
6. Condensation Resistance (I): When tested to CSA A-440, the condensation index shall not be less than:
  - a.  $60_{\text{frame}}$  and  $62_{\text{glass}}$  (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, coordination of doors and 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, coordination of doors and 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 and Aluminum Curtain Wall Systems 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. Manufacturer's 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. 2" x 4-1/2" (50.8 mm x 114.3 mm) System Dimensions
4. 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, manufacture 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. Trifab Versoleil SunShade: An aluminum sunshade (consisting of outriggers, louvers, and fascia, Blade style shall be "Airfoil" that is anchored directly to the vertical mullions. Outriggers shall be shop painted to match storefront system. Louvers and fascia shall be painted or anodized to match storefront system.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposed shall be stainless steel.
- E. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
- F. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- G. 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: 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: Coordinate with FRP doors as included in the door schedule.
- 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. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- B. 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.
- C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- D. Factory Finishes: Kawneer Permafluor (70%), AAMA 2605, Fluoropolymer Coating. Architect to select from a 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 frame 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/ft<sup>2</sup>, 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

**PART 1 – GENERAL**

**1.01 SUMMARY**

- A. Section includes furnishing, installation and commissioning 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. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Divisions:
  - 1. Division 07 Joint Sealants
  - 2. Division 08 Openings
  - 3. Division 09 Finishes
  - 4. Division 26 Electrical
  - 5. 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 (2016)
  - 2. ANSI/BHMA A156.2 Bored & Preamsembled Locks & Latches (2011)
  - 3. ANSI/BHMA A156.3 Exit Devices (2014)
  - 4. ANSI/BHMA A156.4 Door Controls – Closers (2013)
  - 5. ANSI/BHMA A156.6 Architectural Door Trim (2015)
  - 6. ANSI/BHMA A156.7 Template Hinge Dimensions (2016)
  - 7. ANSI/BHMA A156.8 Door Controls – Overhead Stops and Holders (2015)
  - 8. ANSI/BHMA A156.16 Auxiliary Hardware (2013)
  - 9. ANSI/BHMA A156.18 Materials & Finishes (2016)
  - 10. ANSI/BHMA A156.19 Power Assist & Low Energy Power Operated Doors (2013)
  - 11. ANSI/BHMA A156.21 Thresholds (2014)
  - 12. ANSI/BHMA A156.22 Door Gasketing Systems (2012)
  - 13. ANSI/BHMA A156.26 Continuous Hinges (2012)
  - 14. ANSI/BHMA A156.28 Keying Systems (2013)
- B. International Code Council/American National Standards Institute (ICC/ANSI)/ADA:
  - 1. ICC/ANSI A117.1 Standards for Accessible and Usable Buildings and Facilities 2006
- 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 294 Access Control System Units

- D. Door and Hardware Institute (DHI):
  - 1. DHI Publications – 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 2008
  - 2. NFPA 80 Standard for Fire Doors and Other Opening Protectives 2007
  - 3. NFPA 101 Life Safety Code 2006
  - 4. NFPA 105 Standard for the Installation of Smoke Door Assemblies 2007

### **1.03 SUBMITTALS**

- A. Submit in accordance with Conditions of the Contract and Division 1 Administrative Requirements and Submittal Procedures Section.
- B. Shop Drawings:
  - 1. Organize hardware schedule in vertical format as 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 will affix seal attesting to completeness and correctness, including the review of the 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 an index, and cover sheet.
- D. Templates:
  - 1. Upon final approval of the architectural hardware schedules, submit one set of complete templates for each hardware item to the door manufacturers, frame manufacturers, and the installers. Date and index these 8-1/2 inch x 11 inch papers in a three ring binder, including detailed lists of the hardware location requirements for mortised and surface applied hardware within fourteen days of receiving approved door hardware submittals.
- E. Closeout Submittals: Submit to Owner in a three-ring 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 will employ an Architectural Hardware Consultant (AHC) as certified by DHI and a member of the seal program who will be available at reasonable times during course of work for Project hardware consultation.
- 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. Fired 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 be submitted to Owner and Contractor. Doors failing inspection must be adjusted, replaced or modified to be within appropriate code requirements.
- 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: create a comparison chart that includes the testing information as well as the warranty for both the specified product and the proposed substitution. 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 and will be addressed via addendum prior to bid date.
- I. Meetings: Comply with requirements in Division 1 Section "Project Meetings."
  - 1. Keying Meeting
  - 2. Owner to provide permanent cores
- J. Installer Qualifications: Specialized in performing installation of this Section and have five years minimum documented experience.
- K. Hardware listed in 3.07 – Hardware Schedule is intended to establish minimum level of design, type, function and grade of hardware to be used.



**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Provide clean, dry and secure room for hardware delivered to Project but not yet installed. Shelf hardware off of the floor and with larger items of hardware being stored on wooden pallets. Arrange locksets and keyed cylinders by opening number. Organize the balance of hardware by brand, model of hardware, and hardware set number. Leave the door markings of the hardware visible for installers.
- B. Furnish hardware that is not bulk packed with each unit marked and numbered in accordance with approved finish hardware schedule. Include architect's opening number, hardware set number, and item number for each type of hardware. Include keyset symbols and corresponding hardware component for keyed products.
- C. Pack each item complete with necessary parts and fasteners in manufacturer's original packaging.
- D. Deliver architectural hardware to the job site according to the phasing agreed upon in the pre-installation meeting. Inventory the delivery with the supplier's assistance. Immediately note shortages and damages on the shipping receipts and bill of lading. Coordinate replacement or repair with the supplier.
- E. Owner to provide permanent keys, cores.
- F. Waste Management and Disposal: Separate waste materials for use 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 concurrently with other warranties made by Contractor under requirements of the Contract documents.
- B. Special Warranty: Warranties specified in this article will 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.
- 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 HINGES**

- A. Hinges, electric hinges, and self-closing 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:**

1. Butts and Hinges: ANSI/BHMA A156.1.
2. Template Hinge Dimensions: ANSI/BHMA A156.7.
3. Self-Closing Hinges: ANSI/BHMA A156.17.

**C. Butt Hinges:**

1. Hinge weight and size unless otherwise indicated in hardware sets:
  - a. Doors up to 36" wide and up to 1-3/4" thick provide hinges with a minimum thickness of .134" and a minimum of 4-1/2" in height.
  - b. Doors from 36" wide up to 42" wide and up to 1-3/4" thick provide hinges with a minimum thickness of .145" and a minimum of 4-1/2" in height.
  - c. For doors from 42" wide up to 48" wide and up to 1-3/4" thick provide hinges with a minimum thickness of .180" and a minimum of 5" in height.
  - d. Doors greater than 1-3/4" thick provide hinges with a minimum thickness of .180" and a minimum of 5" in height.
  - e. Width of hinge is to be minimum required to clear surrounding trim.
2. Base material unless otherwise indicated in hardware sets:
  - a. Exterior Doors: 304 Stainless Steel, Brass or Bronze material.
  - b. Interior Doors: Steel material.
  - c. Fire Rated Doors: Steel or 304 Stainless Steel materials.
  - d. Stainless Steel ball bearing hinges to have stainless steel ball bearings. Steel ball bearings are unacceptable.
3. Quantity of hinges per door unless otherwise stated in hardware sets:
  - a. Doors up to 60" in height provide 2 hinges.
  - b. Doors 60" up to 90" in height provide 3 hinges.
  - c. Doors 90" up to 120" in height provide 4 hinges.
  - d. Doors over 120" in height add 1 additional hinge per each additional 30" in height.
  - e. Dutch doors provide 4 hinges.
4. Hinge design and options unless otherwise indicated in hardware sets:
  - a. Hinges are to be of a square corner five-knuckle design, flat button tips and have ball bearings unless otherwise indicated in hardware sets.
  - b. Out-swinging exterior and out-swinging access controlled doors are required to have Non-Removable Pins (NRP) to prevent removal of pin while door is in closed position.
  - c. 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.
  - d. When shims are necessary to correct frame or door irregularities, provide metal shims only.

**5. Acceptable Manufacturers:**

	Standard Weight	Heavy Weight
Hager	BB1279/BB1191	BB1168/BB1199
Bommer	BB5000/BB5002	BB5004/BB5006

**2.02 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 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. Size length of hinge to equal the actual 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 be coated with TFE dry lubricant.
  2. Bearings:
    - a. Vertical loads be carried on Lubriloy RL bearings for non-fire rated doors.
    - b. Continuous hinges are to 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. Hinges to have Rounded Back Cover Channel (RBCC).
    - b. 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.
    - c. At fire rated openings provide hinges that carry a 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
Hager	780-112HD / 780-224HD
Bommer	FMSLFHD
Zero	910A

### **2.03 FLUSH BOLTS AND COORDINATORS**

- A. Flush bolts of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Standards: Manufacturer to be listed by the following: Auxiliary Hardware: ANSI/BHMI A156.16.
- C. Labeled openings: Provide automatic or constant latching flush bolts per hardware schedule for inactive leaf of pairs of doors. Provide dust proof strikes for bottom bolt.
- D. Non-Labeled openings: Provide two flush bolts for inactive leaf of pairs of doors per hardware schedule. Provide extension rods so that the center line of the top flush bolt is not more than 78" above the finish floor. Provide dust proof strike from bottom bolt.
- E. Acceptable Manufacturers:

		Auto Flush Bolt	Dust Proof Strike
Hager		291D	280X
Rockwood		1942	570
Trimco		3815	3911

- F. Coordinators: Provide for labeled pairs of doors with automatic flush bolts or with vertical rod exit device with a mortise-locking device per hardware schedule. Provide filler piece to extend full width of stop on frame. Provide mounting brackets for closers and special preparation for latches where applicable.

- G. Acceptable Manufacturers:

	Coordinator	Bracket	Bracket for stops greater than 2-1/4."
Hager	297	297M	297N
Rockwood	1600	1601AB	1601C
Trimco	3094	3095	3096

## **2.04 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 1150 lbf (100 psf) 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 A1117.1
- C. Lock and latch function numbers and descriptions of manufacturer's 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 resist against vandalism.
  3. Non-handed, field reversible.
  4. Thru-bolt mounting with no exposed screws.
  5. Levers, zinc cast and plated to match finished 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" latch bolt for pairs of fire-rated doors where required by door manufacturer. 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:

SARGENT – NO SUBSTITUION	10 Line Series

**2.05 EXIT DEVICES**

- A. Exit Devices of one manufacturer as listed for continuity of design and consideration of warranty. Touchpad 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.
  6. 2007 Florida Building Code Certification Number: FL9481.1.
  7. ANSI/BHMA A250.13 Severe Windstorm Resistant Component.
- C. Material and Design:
1. Provide exit devices with actuators that extend a minimum of one-half of door width.
  2. Where trim is indicated in hardware sets provide the lever design to match design of lock levers.
  3. Exit device to mount flush with door.
  4. Latchbolts:
    - a. Rim device – 3/4" throw, Pullman type with automatic dead-latching, stainless steel
    - b. Surface vertical rod device – Top 1/2" throw, Pullman type with automatic dead-latching, stainless steel.  
Bottom 1/2" throw, Pullman type, held retracted during door swing, stainless steel.
  5. 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. Electric Modifications:
1. Latch Retraction (EL): retracts the latch bolt for momentary or maintained periods of time.

F. Acceptable Manufactures:

Sargent – NO SUBSTITUTION	80 Series	8500 Series

**2.06 CYLINDERS AND KEYING**

- A. Cylinders of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Products to be certified and listed by 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, BEST IC core AS DIRECTED BY ARCHITECT/OWNER.
  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 Owner's 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. Keys to be shipped to Owner's Representative, individually tag per keying conference.
4. Provide visual key control identification on keys.
5. Provide interchangeable construction cores with 50 construction keys as required per the keying meeting.

**E. Acceptable Manufacturers:**

SARGENT – NO SUBSTITUTION    RA, RB, RC, RD KEYWAY

**2.07 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 recommendations for size of closer, depending on width of door, frequency of use, atmospheric pressure, ADAAG requirement, 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 Complaint 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 will have separated 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 (ADAAG). 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, self-tapping wood and machine screws, and sex nuts and bolts for each closer.

G. Acceptable manufacturers:

Hager	5100
LCN	4041

## **2.08 LOW ENERGY POWER OPERATORS**

A. Low energy power operators of one manufacturer as listed for continuity of design and consideration of warranty.

B. Products to be certified and listed by the following:

1. Power Assist and Low Energy Power Operated Doors: ANSI/BHMA A156.19.
2. ADA Complaint ANSI A117.1.

C. Materials and Design:

1. Self-contained electrical control unit, including necessary transformers, relays, rectifiers, and other electronic components for proper operation, switching and control of door up to 350 lbs. and also include time delay for normal cycle.
2. On pairs of doors, either door to be opened manually without the other door opening.
3. Operates as a mechanical closer if power is disconnected. Forces consistent with ANSI A117.1 and ANSI A156.19.
4. Provide delay switches for motor activation, exit device latch retraction interfacing and hold open times. Hold open times to be adjustable from 1 second to continuous seconds.
5. Adjustable vestibule sequencing input for operation of two or more units. Specify 2-659-0240.
6. Adjustable powered swing degree from 80 degrees to 110 degrees.
7. Integral obstruction detection for closing and opening cycle.
8. Adjustable built-in stop, set from 80 degrees maximum to 180 degrees manual swing.
9. When in "blow open" operation for smoke ventilation, operator will stay in the open position when loss of power.
10. Boost to close selectable on/off switch.

D. Signage: Provide signage in according to the requirements of ANSI/BHMA A156.19.

E. Acceptable Manufacturers:

Hager	8400 Series
LCN	4640 Series

F. Actuators:

1. Opening cycle activated by pressing switches with international symbol of accessibility and "PUSH TO OPEN" engraved on faceplate.
2. Switches installed in standard 2-gang electrical wall box and placed in a location in compliance with ANSI A117.1.
3. Wireless actuators optional.

4. Provide bollards as required where a suitable wall mount is not possible.

G. Acceptable Manufacturers:

Hager
MS Sedco
SDC

**2.09 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 door width on pull side of door. For pairs of doors, size one inch less door width (LDW) on push side of door, and 1/2 inch on pull side of door. Adjust sizes to accommodate accompanying hardware, such as, edge guards, astragals and others.
1. Kick Plates 10" high or sized to door bottom rail height.
  2. Mop Plates 4" high.
- C. Products to be certified and listed by the following:
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 so they run across door width of plate.
  3. Bevel top, bottom, and sides uniformly leaving no sharp edges.
  4. Countersink holes for screws. Space screw holes so they are no more than eight inches CTC, along a centerline not over 1/2" in from edge around plate. End screws maximum of 0.53" 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 manufacturer's UL listing for maximum height and width of protection plate to be used.

F. Acceptable Manufacturers:

Hager	190S
Trimco	
Burns	

**2.10 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. Products to be certified and listed by the following:

1. Auxiliary Hardware: ANSI/BHMA A156.16.

D. Acceptable Manufacturers:

	Convex	Concave
Hager	230W	234W
Trimco		
Burns		

E. Overhead Stops and Holders: Provide overhead stops 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. Products to be certified and listed by the following:

1. Overhead Stops and Holders: ANSI/BHMA A156.8 Grade 1.

G. Acceptable Manufacturers:

	Heavy Duty Surface	
Hager	7000 SRF Series	
Glynn Johnson	90 SRF Series	
Sargent	590 Series	

## **2.11 ELECTROMAGNETIC HOLDERS**

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

B. Products to be certified and listed by the following:

1. ANSI A156.15 Grade 1.
2. UL/ULC Listed.
3. California State Fire Marshall listed (CSFM).
4. City of New York MEA approved.

C. Material and Design:

1. Provide electromagnetic holders where self-closing fire doors and smoke barrier doors are required to be held open. Electromagnetic holders to be fail-safe: when electrical current is interrupted, doors release to close automatically. Holding force 25-40 lbs.

D. Acceptable Manufacturers:

Hager	380 Series
LCN	
Rixson	

## **2.12 KEY SWITCHES**

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

- B. Material and Design:
1. Single gang, wall mounted, recessed mortise cylinder.
  2. Tamper-resistant spanner screws.
  3. 20 gauge stainless steel faceplate.
- C. Functions:
1. Momentary (MO).
  2. Timed actuation (1-60 seconds).
  3. Alternate action (on/off) (AA).
- D. Options:
1. Anti-tamper switch (ATS).
  2. One (1) green Led (LEDG).
  3. One (1) red LED (LEDR).
  4. One (1) green LED and one (1) red LED (2.LED).

E. Acceptable Manufacturers:

	(AA) SPDT	(MO) SPDT	(AA) DPDT	(MO) DPDT
Hager	29KS ASD	29KS MSD	29KS ADD	29KS MDD
SDC	701	702	705	706
RCI				

**2.13 MODULAR ACCESS CONTROL POWER SUPPLIES**

- A. Power supplies of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Products to be certified and listed by the following:
1. UL Listed.
- C. Design:
1. Use with modular access control systems.
  2. Field selectable filtered and regulated 12 VDC or 24 VDC constant voltage.
  3. 1, 2, 4, and 6 AMP load capacities . Match the power supply amperage to the total load of the opening /system plus an additional thirty percent to cover line drop, as well as possible expansion.
  4. Circuit breaker protected AC input voltage, secondary output PTC protected.
  5. Fire alarm input provides simultaneous release of fail-safe locks and holders.
  6. Interface relay.
  7. LED status indicators provide information regarding AC input, DC output, and battery backup status.
  8. Separate inputs for activation switch on entry and egress and ingress side of opening.
  9. 5 amp hour battery backup.
  10. Input 115 VAC (230 VAC optional).
  11. Optional dual 12 VDC or 24 VDC output.
  12. Optional power supply monitor module to monitor power supply status, A/C power, and D/C output and battery Status
- D. Include optional modules as required to properly interface, control, and sequence the hardware with the access control system.

E. Acceptable Manufacturer:

Sargent	3541	3 Amp

**2.14 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. American with Disabilities Act Accessibility Guidelines (ADAAG).

D. Acceptable Manufacturers:

Hager	417S/520S
K.N. Crowder	
Reese	

**2.15 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 noncorrosive 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 buttons: 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. Products to be certified and listed by the following:
1. Door Gasketing and Edge Seal Systems: ANSI/BHMA A156.22.
  2. BHMA certified for door sweeps, automatic door bottoms, and adhesive applied gasketing.
- 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.

G. Acceptable Manufacturers:

1. Perimeter Gasketing:

	Stop Applied	Adhesive Applied
Hager	881S	736
K.N. Crowder		
Reese		

2. Meeting Stile Weatherstrip:

Hager	802S / 756S
K.N. Crowder	
Reese	

3. Overlapping Astragal:

Hager	835S
K.N. Crowder	
Reese	

4. Door Bottom Sweeps:

Hager	770SV
K.N. Crowder	
Reese	

5. Automatic Door Bottoms:

Hager	730S
K.N. Crowder	
Reese	

6. Overhead Drip Guard

Hager	810S
K.N. Crowder	
Reese	

## **2.16 DOOR VIEWER**

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

B. Products to be certified and listed by the following:

1. Auxiliary Hardware: ANSI/BHMA A156.16 for L033221.

C. Design:

1. Adjustable for use on doors 1-3/8" to 2-1/8" thick doors, 9/16" hole required.
2. One way 200-degree view.
3. Tamper resistant with a privacy flap.
4. 90 min. fire rating.

D. Acceptable Manufacturers:

Hager	1759
Rockwood	
Trimco	

**2.17 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. Products to be certified and listed by the following:
1. Auxiliary Hardware: ANSI/BHMA A156.16

C. Acceptable Manufacturers:

	Hollow Metal Frame	
Hager	307D	
Rockwood		
Trimco		

**2.18 KEY CABINET**

- A. Provide key cabinet; surface mounted to wall.
- B. Key control system:
1. Include two sets of key tags, hooks, labels, and envelopes.
  2. Contain system in metal cabinet with baked enamel finish.
  3. Capacity will be able to hold actual quantities of keys, plus 50 percent.
  4. Provide tools, instruction sheets, and accessories required to complete installation.

C. Acceptable Manufacturers:

Lund Equipment
Telkee Incorporated
Key Control

**2.19 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 Installers present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

#### **3.02 INSTALLATION**

- A. Install hardware using manufactures recommended fasteners and installation instructions, at height locations and clearance tolerances that comply 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. Approved shop drawings
  - 8. Approved finish hardware schedule
- B. Install soffit mounted gaskets prior other soffit mounted hardware to provide a continuous seal around the perimeter of the opening without cutting or notching.
- C. Install door closers so they are on the interior of the room side of the door. Stairwell doors will have closers mounted on the stair side and exterior doors will be mounted on the interior side of the building.
- D. In drywall applications provide blocking material of sufficient type and size for hardware items that mount directly to the wall.
- E. Locate wall mounted bumper to contact the trim of the operating trim.
- F. Mount mop and kick plates flush with the bottom of the door and centered horizontally on the door.
- G. Set thresholds for exterior, and acoustical doors at sound control openings in full bed of sealant complying with requirements specified in Division 07 Section “Joint Sealants” forming a tight seal between threshold and surface to which set.
- H. Anchor all components firmly into position and use anchoring devices furnished with the hardware item, unless otherwise specified.
- I. 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.

- J. Power Supplies: locate power supplies as indicated and if not indicated on the plans above accessible ceilings on secure side of doors. Verify locations with Architect.

### **3.03 FIELD QUALITY CONTROL**

- A. Material supplier to schedule final walk through to inspect hardware installation ten (10) business days before final acceptance of Owner. Material supplier will provide a written report detailing discrepancies of each opening to General Contractor within seven (7) 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 finish hardware per manufacturer's instructions after final adjustments have been made. Replace items that cannot be cleaned to manufacturer's level of finish quality at no cost to Owner.
- C. Conduct a training class for building maintenance personnel demonstrating the adjustment, operation of mechanical and electrical hardware. Special tools for finish hardware to be turned over and explained usage at the 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. Intent of Hardware Groups
  1. Should items of hardware not specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
  2. Where items of hardware aren't correctly specified and are required for completion of the Work, a written statement of such omission, error, or other discrepancy is required to be submitted to Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.
- B. 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.
- C. Hardware schedule does not reflect handing, backset, method of fastening, and like characteristics of door hardware and door operation.
- D. 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**

Hardware Sets

SET #1 Classrooms

Doors: 106, 107, 108, 112, 113, 114

3 Hinges	BB1279 4 1/2 X 4 1/2	US26D	HA
1 Classroom Security Intruder	28-63-10G38-LL	US26D	SA
1 Door Closer	5100 MLT ALM	689	HA
1 Kick Plate	190S 10" x 2" LDW	US32D	HA
1 Wall Stop	230W	US26D	HA
3 Silencers	307D		HA

SET #2 Instrument Storage

Doors: 109, 110

6 Hinges	BB1279 4 1/2 x 4 1/2	US26D	HA
2 Flushbolt	282D	US26D	HA
1 Dustproof Strike	280X	US26D	HA
1 Classroom	28-63-10G37-LL	US26D	HA
2 Door Closer Hold-Open	5100-PAR-HDHOS ALM	689	HA
2 Kick Plate	190S 10" x 34"	US32D	HA
2 Wall Stop	230W	US26D	HA
2 Silencers	307D		HA

SET #3 Exterior

Doors: 101, 102, 104, 119

2 Continuous Hinge	780-224HD 83" CLR	ALM	HA
2 Rim Exit Device	AD 19-43-63-8884 F ETL TB	32D	SA
1 Mullion	63-L980A	USP	SA
2 Closer	5100-PAR-HDCS ALM	689	HA
2 Bracket	5111 ALM	689	HA
2 Blade Stop Spacer	5113 ALM	689	HA
1 Gasketing	By Frame Mfr.		
2 Meeting Stiles	By Frame Mfr.		
2 Door Bottom	770S VINYL 36"	MIL	HA
1 Threshold	520S VINYL 72"	MIL	HA



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**DOOR HARDWARE  
SECTION 08 71 00**

**SET #4 Corridor**

Door: 103

6 Hinge	BB1279 4 1/2 x 4 1/2	US26D	HA
2 Less Bottom Rod Device	12-19-43-63-NB8713 F TB	32D	SA
2 Closer	5100-MLT ALM	689	HA
2 Magnetic Hold-Open	380F 24V120V LS	ALM	HA
1 Gasketing	736S 240"	CHA	HA
2 Meeting Stiles	872S NEOPRENE 84" CLR	ALM	HA

Note: Magnetic Hold-Open devices are tied into the fire alarm system to release upon activation.

**SET #5 Corridor**

Door: 105

6 Hinge	BB1279 4 1/2 x 4 1/2	US26D	HA
2 Less Bottom Rod Device	19-43-63-NB8713 F TB	32D	SA
2 Closer	5100-MLT ALM	689	HA
2 Magnetic Hold-Open	380F 24V120V LS	ALM	HA
1 Gasketing	736S 240"	CHA	HA

Note: Magnetic Hold-Open devices are tied into the fire alarm system to release upon activation.

**SET #6 Corridor**

Door: 118

6 HW Hinge	BB1168 5 x 4 1/2	US26D	HA
2 Less Bottom Rod Device	12-19-43-63-NB8713 G TB	32D	SA
2 Closer	5100-MLT ALM	689	HA
2 Magnetic Hold-Open	380F 24V120V LS	ALM	HA
1 Gasketing	736S 264"	CHA	HA
2 Meeting Stiles	872S NEOPRENE 84" CLR	ALM	HA

Note: Magnetic Hold-Open devices are tied into the fire alarm system to release upon activation.

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**DOOR HARDWARE  
SECTION 08 71 00**

**SET #7 Mechanical, Janitor**

Doors: 116, 117, 120

3 Hinge	BB1279 4 1/2 X 4 1/2	US26D	HA
1 Storeroom	28-63-10GO4-LL	US26D	SA
1 Closer	5100 MLT ALM	689	HA
1 Wall Stop	230W	US26D	HA
1 Kick Plate	190S 10" x 34"	US32D	HA
1 Smoke Seal	736S 204"	S	HA

**SET #8 Staff Restroom**

Door: 111

3 Hinge	BB1279 4 1/2 X 4 1/2	US26D	HA
1 Privacy	28-10U65-LL	US26D	SA
1 Closer	5100 MLT ALM	689	HA
1 Wall Stop	234W	US26D	HA
1 Kick Plate	190S 10" x 34"	US32D	HA
1 Mop Plate	190S 4" x 35"	US32D	HA
3 Silencers	307D		HA

**SET #9 Double-Egress Corridor**

Door: 115

6 HW Hinge	BB1168 5 x 4 1/2	US26D	HA
2 Less Bottom Rod Device	12-19-43-NB8710 G TB	32D	SA
2 Closer	5100-MLT ALM	689	HA
2 Magnetic Hold-Open	380F 24V120V LS	ALM	HA
1 Gasketing	736S 264"	CHA	HA
2 Meeting Stiles	872S NEOPRENE 84" CLR	ALM	HA

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 safety 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	1" PPG Solarban 70XL (2) with Clear Glass on one lite.
Exterior Glazing 2	1" PPG Graylite II on Solar Gray
Impact Resistant Glass	7/16" ArmorProtect® Plus 12100 by Oldcastle
Insulating Unit Construction: 1/4 inch "Solarban" 70XL (Glazing 2 Solarban 67) Solar Control (Sputtered) on second surface (2), + 1/2 inch (13mm) air space + 1/4 inch (6mm) Clear Float Glass (Glazing 2 Solar Gray).	

END OF SECTION 08800

**SECTION 08817 – FIRE-RATED GLASS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Fire-rated glazing materials installed as windows in fire-rated frames.
- B. Related Sections include the following:
  - 1. Section 08110 “Steel Doors and Frames” for vision panels in interior doors and interior vision panel (borrowed lites) frames.

1.2 REFERENCES

- 1. ASTM E2074-00: Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.
- 2. ASTM E2010-01: Standard Test Method for Positive Pressure Fire Tests of Window Assemblies.
- B. American National Standards Institute (ANSI):
  - 1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings
- C. Consumer Product Safety Commission (CPSC):
  - 1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials
- D. Glass Association of North America (GANA):
  - 1. GANA – Glazing Manual.
  - 2. FGMA – Sealant Manual.
- E. National Fire Protection Association (NFPA):
  - 1. NFPA 80: Fire Doors and Windows.
  - 2. NFPA 252 – Fire Tests of Door Assemblies.
  - 3. NFPA 257 – Fire Tests of Window Assemblies.
- F. Underwriters Laboratories, Inc. (UL):
  - 1. UL 9 – Fire Tests of Window Assemblies.
  - 2. UL 10B – Fire Tests of Door Assemblies.
  - 3. UL 10C – Positive Pressure Fire Tests of Door Assemblies.

1.3 PERFORMANCE REQUIREMENTS

- A. Fire-rated glass ceramic laminated clear and wireless glazing material for use in impact safety-rated locations such as doors, transoms and borrowed lites with fire rating requirements ranging from 20 minutes to 3 hours with hose stream test.
- B. Passes positive pressure test standards UL10C, UBC 7-2 and UBC 7-4.

1.4 SUBMITTALS

- A. Comply with requirements of Division 1 – General Requirements
- B. Product Data: Submit manufacturer's technical data for each glazing material required, including installation and maintenance instructions.
- C. Certificates of compliance from glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements. Separate certification will not be required for glazing materials bearing manufacturer's permanent label designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.
- D. Product Test Listings: From UL indicating fire-rated glass complies with requirements, based on comprehensive testing of current product.
- E. Samples: Submit, for verification purposes, approx. 8-invh by 10-inch sample for each type of glass indicated.

1.5 QUALITY ASSURANCE

- A. Glazing Standards: FGMA Glazing Manual and Sealant Manual.
- B. Fire Protective Rated Glass: Each lite shall bear permanent, nonremovable label of UL certifying it for use in tested and rated fire protective assemblies.
- C. Fire Protective Glazing Products for Door Assemblies: Products identical to those tested per ASTM E2074-00 and UL 10B, labeled and listed by UL.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to specified destination in manufacturer's or distributor's packaging, undamaged, complete with installation instructions.
- B. Store off ground, under cover, protected from weather and construction activities.

1.7 WARRANTY

- A. Provide manufacturer's limited warranty.
- B. Warranty Period: Five years from date of Final Completion.

PART 2 - PRODUCTS

2.1 FIRE-RATED GLAZING MATERIALS

- A. Manufacturer: FireLite®Plus as manufactured by Nippon Electric Glass Company, Ltd., and distributed by Technical Glass Products, Kirkland, Washington. Other manufactures meeting the performance requirements of this specification.

- B. Properties:
  - 1. Thickness: 5/16 inch [8 mm] overall.
  - 2. Weight: 4 lbs./sq. ft.
  - 3. Approximate Visible Transmission: 85 percent.
  - 4. Approximate Visible Reflection: 9 percent.
  - 5. Fire-rating: 90 minutes.
  - 6. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).
  - 7. STC Rating: Approximately 35 dB.
  - 8. Surface Finish: Premium (polished).
  - 9. Positive Pressure Test: UL 10C, UBC 7-2 and 7-4; passes.
- C. Maximum sheet sizes based on surface finish:
  - 1. Premium: 48 inches by 96 inches.
- D. Labeling: Permanently label each piece of FireLite®Plus with the FireLite® logo, UL logo and fire rating in sizes up to 3,325 sq. in., and with the FireLite label only for sizes that exceed the listing (as approved by the local authority having jurisdiction).
- E. Fire Rating: Fire rating listed and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with [ASTM E2074-00 and ASTM E2010-01] [ULC Standards CAN4 S-104 and CAN4 S-106] [NPFA 252 and NFPA 257] [UL 9, UL 10B and UL 10C].

## 2.2 GLAZING COMPOUND FOR FIRE-RATED GLAZING MATERIALS

- A. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent. Glass panels that exceed 1,393 sq. inches for 90-minute ratings must be glazed with fire-rated glazing tape supplied by manufacturer.
- B. Setting Blocks: Neoprene, EPDM, or silicone; tested for compatibility with glazing compound; of 70 to 90 Shore A hardness.
- C. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

## 2.3 FABRICATION

- 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 recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine glass framing, with glazier present, for compliance with the following:
  - 1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
  - 2. Minimum required face or edge clearances.
  - 3. Observable edge damage or face imperfections.
- B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

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

### 3.2 INSTALLATION (GLAZING)

- A. Comply with referenced FGMA standards and instructions of manufacturers of glass, glazing sealants, and glazing compounds.
- B. Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.
- C. Set units of glass in each series with uniformity of pattern, draw, bow, and similar characteristics.
- D. Cut glazing tape to length and set against permanent stops, flush with sight lines to fit openings exactly, with stretch allowance during installation.
- E. Place setting blocks located at quarter points of glass with edge block no more than 6 inches from corners.
- F. Glaze vertically into labeled fire-rated metal frames or partition walls with same fire rating as glass and push against tape for full contact at perimeter of pane or unit.
- G. Place glazing tape on free perimeter of glazing in same manner described above.
- H. Install removable stop and secure without displacement of tape.
- I. [Use specified glazing compound, without adulteration; bed glazing material in glazing compound; entirely fill all recess and spaces. Provide visible glazing compound with smooth and straight edges.]
- J. Install in vision panels in fire-rated doors to requirements of NFPA 80.
- K. Install so that appropriate [UL] [FireLite®Plus] markings remain permanently visible.

### 3.3 PROTECTION AND CLEANING

- A. Protect glass from contact with contaminating substances resulting from construction operations. Remove any such substances by method approved by glass manufacturer.
- B. Wash glass on both faces not more than four days prior to date scheduled for inspections intended to establish date of substantial completion. Wash glass by method recommended by glass manufacturer.

### 3.4 GLAZING SCHEDULE

A. See drawings for locations of fire rated glazing.

Rating	Assembly	Max. Exposed Area (Sq. In.)	Max. Width Of Exposed Glazing (In.)	OR	Max. Height Of Exposed Glazing (In.)	Stop Height
20 min.	Doors					
	HMS or Wood*	3,204	36		89	5/8"
	Fireframes D.S.	3,204	36		89	3/4"
	Other than doors					
	HMS or Wood	3,325	95		95	5/8"
	Fireframes D.S.	3,325	95		95	3/4"
45 min.	Doors					
	HMS or Wood	3,204	36		89	5/8"
	Fireframes D.S.	3,204	36		89	3/4"
	Other than doors					
	HMS or Wood	3,325	95		95	5/8"
	Fireframes D.S.	3,325	95		95	3/4"
60 min.	Doors (non-temp rise)					
	HMS or Wood	3,204	36		89	5/8"
	Fireframes D.S.	3,204	36		89	3/4"
	Doors (temp rise)	100	12		33	5/8"
	Other than doors					
	HMS or Wood	3,325	95		95	5/8"
	Fireframes D.S.	3,325	95		95	3/4"
90 min.	Doors (non-temp rise)	2,034	36		56 1/2"	3/4"
	Doors (temp rise)	100	12		33	1/2"
	Other than doors					
	HMS	2,627	56 1/2"		56 1/2"	5/8"
	Fireframes D.S.	2,627	56 1/2"		56 1/2"	3/4"
3 hours	Doors	100	12		33	1/2"

\* HMS indicates hollow metal steel framing. Fireframes D.S. indicates Designer Series narrow profile framing by Forster. For wood frames, check with manufacturer for maximum tested glass sizes.

END OF SECTION



## **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.

2. ½” DensDeck Roof Board wherever Membrane roofing shall be adhered to sheathing.
  - 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 - Fiberock Brand VHI Panels. Thickness: 5/8 inch (15.9 mm).
  - 2. Type: Type X where required for fire-resistance-rated assemblies.
  - 3. Type: Curved applications: 2 layers of 1/4".
  - 4. Exterior: See 09250 – Exterior Sheathing.
  - 5. 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 09301 - TILE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Ceramic mosaic tile.
  - 2. Pressed floor tile.
  - 3. Porcelain tile.
  - 4. Glazed wall tile.
  - 5. Glass mosaic tile.
  - 6. Stone thresholds.
  - 7. Tile backing panels.
  - 8. Waterproof membrane for thinset applications.
  - 9. Crack isolation membrane.
  - 10. Metal edge strips.

#### 1.3 REFERENCES

- A. ANSI A108/A1118 Series: American National Standards for Installation of Ceramic Tile.
- B. ANSI A137.1: American National Standard Specifications for Ceramic Tile.
- C. ISO 13007: International Standards Organization; Classification for Grout and Adhesives.
- D. TCNA (HB); Handbook for Ceramic, Glass and Stone Tile Installation; Tile Council of North America.

#### 1.4 DEFINITIONS

- A. Module Size: Actual tile size plus joint width indicated.
- B. Face Size: Actual tile size, excluding spacer lugs.

#### 1.5 PREINSTALLATION MEETINGS

- 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

## 1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
- C. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- D. Samples for Initial Selection: For tile, grout, and accessories involving color selection.
- E. Samples for Verification:
  - 1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
  - 2. Full-size units of each type of trim and accessory for each color and finish required.
  - 3. Stone thresholds in 6-inch (150-mm) lengths.
  - 4. Metal edge strips in 6-inch (150-mm) lengths.

## 1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product.
- D. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

## 1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
  - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

## 1.9 QUALITY ASSURANCE

- A. Manufacturer Qualifications:

1. Provide installation products of this section by companies which have successfully specialized in production of this type for not less than five years.
  2. Installation product must have a hydraulic cement-based inorganic binder content to include Portland cement ASTM C150; Standard Specification for Portland Cement and other specialty hydraulic cements. Gypsum-based products are not acceptable.
- B. Installer Qualifications:
1. Installer is a five-star member of the National Tile Contractors Association
- C. 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 each type of floor tile installation.
  2. Build mockup of each type of wall tile installation.
  3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

#### 1.11 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

#### 1.12 WARRANTY

- A. System Warranty: Provide a minimum 1 year, non pro-rated, comprehensive warranty for the tile and stone installation products.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
  1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
  2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
  1. Stone thresholds.
  2. Waterproof membrane.
  3. Crack isolation membrane.
  4. Cementitious backer units.
  5. Metal edge strips.

## 2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

## 2.3 TILE PRODUCTS

- A. Porcelain Tile Type Floor: Unglazed pressed floor tile.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Shaw Industries
    - b. Daltile
    - c. American Olean
    - d. Interceramic
  2. Certification: Tile certified by the Porcelain Tile Certification Agency.
  3. Composition: Impervious natural clay or porcelain
  4. Face Size: nominal **12 by 12 inches**
  5. Thickness: 1/4 inch
  6. Face: Plain with square or cushion edges
  7. Dynamic Coefficient of Friction: Not less than 0.42.
  8. Tile Color and Pattern: As selected by Owner from manufacturer's full range
  9. Grout Color: As selected by Owner from manufacturer's full range.
  10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable **and matching characteristics of adjoining flat tile**. Provide shapes as follows, selected from manufacturer's standard shapes:

- a. Base Cove: Cove, module size **same as adjoining flat tile.**
- b. Base Cap for Thinset Mortar Installations: Surface bullnose, module size **same as adjoining flat tile.**
- c. Wainscot Cap for Thinset Mortar Installations: Surface bullnose, module size **same as adjoining flat tile.**
- d. External Corners for Thinset Mortar Installations: Surface bullnose, module size.
- e. Internal Corners: Cove, module size **same as adjoining flat tile.**

## 2.4 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
  - 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/4 inch (12.7 mm) or less above adjacent floor surface.
- B. Marble Thresholds: ASTM C 503/C 503M, with a minimum abrasion resistance of **10** according to ASTM C 1353 or ASTM C 241/C 241M and with honed finish.
  - 1. Description: Uniform, fine- to medium-grained white stone with gray veining.

## 2.5 TILE BACKING PANELS

- A. Cement Backer Board: ASTM C 1288, in maximum lengths available to minimize end-to-end butt joints.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. USG, Durock Cement Board with EdgeGuard.
    - b. James Hardie Building Products, Hardie Backer Board with HydroDefense.
    - c. National Gypsum Company, PermaBASE Cement Board.
  - 2. Thickness: **1/2"**

## 2.6 WATERPROOF MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Latex-Portland Cement Waterproof Mortar: Flexible, waterproof mortar consisting of cement-based mix and latex additive.

1. Basis-of-Design Product: Subject to compliance with requirements, provide ARDEX GmbH; Ardex 8+9™ Waterproofing Compound or a comparable product by one of the following:
  - a. MAPEI Corporation.
  - b. TEC; H.B. Fuller Construction Products Inc.

## 2.7 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.12. Include reinforcement and accessories recommended by manufacturer.
- B. Latex-Portland Cement Crack-Resistant Mortar: Flexible mortar consisting of cement-based mix and latex additive.
  1. Basis-of-Design Product: Subject to compliance with requirements, provide ARDEX Americas; Ardex 8+9™ Waterproofing and Crack Isolation Compound or a comparable product by one of the following:
    - a. MAPEI Corporation.
    - b. TEC; H.B. Fuller Construction Products Inc.

## 2.8 SETTING MATERIALS

- A. Latex-Portland Cement Mortar (Thinset): ANSI A118.4 and/or conforms with ISO 13007.
  1. Basis-of-Design Product: Subject to compliance with requirements, provide ARDEX Americas; latex-portland cement mortar (thinset) or a comparable product by one of the following:
    - a. Bostik, Inc.
    - b. TEC; H.B. Fuller Construction Products Inc.
  2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
  3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

## 2.9 GROUT MATERIALS

- A. High-Performance Sanded Tile Grout: ANSI A118.7 and/or conforms to EN 13888 and/or ISO 13007 CG2 WA.
  1. Basis-of-Design Product: Subject to compliance with requirements, provide ARDEX Americas; FL Rapid Set, Flexible Sanded Grout or a comparable product by one of the following:
    - a. Bostik, Inc.
    - b. TEC; H.B. Fuller Construction Products Inc.

2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

## 2.10 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated. Use same manufacturer as the adhesive manufacturer.
  1. Basis-of-Design Product: Subject to compliance with requirements, provide ARDEX Americas; trowelable underlayment or a comparable product by one of the following:
    - a. TEC; H.B. Fuller Construction Products Inc.
- B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- C. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Custom Building Products.
    - b. TEC; H.B. Fuller Construction Products Inc.

## 2.11 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other

- substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with **thinset mortar** comply with surface finish requirements in ANSI A108.01 for installations indicated.
    - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
  3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
  4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with **thinset mortar** with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

### 3.3 CERAMIC TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
  1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
    - a. Exterior tile floors.
    - b. Tile floors in wet areas.
    - c. Tile swimming pool decks.
    - d. Tile floors in laundries.
    - e. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
    - f. Tile floors consisting of rib-backed tiles.



- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
  - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
  - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
  - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
  - 1. Ceramic Tile: **1/4 inch**
- H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, as required. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
  - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
  - 1. Do not extend **waterproofing or crack isolation membrane** under thresholds set in **dry-set portland cement** mortar. Fill joints between such thresholds and adjoining tile set on **waterproofing or crack isolation membrane** with elastomeric sealant.

### 3.4 TILE BACKING PANEL INSTALLATION

- A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. **Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.**

### 3.5 WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
- B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

### 3.6 CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
- B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

### 3.7 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
  - 1. Remove grout residue from tile as soon as possible.
  - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

### 3.8 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 09301

**SECTION 09511 - ACOUSTICAL PANEL CEILINGS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes acoustical panel ceilings installed with exposed suspension systems.

**1.2 SUBMITTALS**

- A. Product data for each type of product specified.
- B. Samples: Submit samples of the following:
  - 1. 6 inch square samples of each acoustical panel type, pattern, and color.
  - 2. Set of 6 inch long samples of exposed suspension system members, including moldings, for each color and system type required.

**1.3 QUALITY ASSURANCE**

- A. Installer Qualifications: Engage an experienced Installer who has successfully completed acoustical ceilings similar in materials, design, and extent to those indicated for Project.
- B. Fire-Performance Characteristics: Provide acoustical ceilings that are identical to those tested for the following fire performance characteristics, according to ASTM test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
  - 1. Surface Burning Characteristics: As follows, tested per ASTM E 84, and complying with ASTM E 1264 for Class A products.
    - a. Flame Spread: 25 or less.
    - b. Smoke Developed: 50 or less.
- C. Single-Source Responsibility for Ceiling Units: Obtain each type of acoustical ceiling unit from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
- D. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
- E. Coordination of Work: Coordinate layout and installation of acoustical ceiling units and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition system (if any). Do not install panels prior to the approval by the Owner and Architect of all of the work above the ceiling, including, but not limited to Mechanical, Electrical, Plumbing, and Structural. All four corners of grid at all locations of ceiling mounted projectors shall be supported.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface

contamination, and other causes.

- B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.

#### 1.5 PROJECT CONDITIONS

- A. Space Enclosure: Do not install interior acoustical ceilings until space is enclosed, conditioned, and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient conditions of temperature and humidity will be continuously maintained at values indicated for final occupancy.

### PART 2 - PRODUCTS

#### 2.1 ACOUSTICAL CEILING UNITS, GENERAL

- A. Standard for Acoustical Ceiling Units: Provide manufacturer's standard units of configuration indicated that comply with ASTM E 1264 classifications as designated by reference to types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
- B. Colors and Patterns: Provide products to match appearance characteristics indicated under each product type.

#### 2.2 MINERAL-BASE PANELS - WATER FELTED

- A. Type, Form, and Finish: Provide Type III, Form 2 units per ASTM E 1264 with painted finish that comply with pattern and other requirements indicated.
- B. Perforated and Fissured Pattern: Units matching pattern indicated by reference to manufacturer standard pattern designations, with other characteristics as follows:
  - 1. Color/Light Reflectance Coefficient: White/LR 0.80.
  - 2. Noise Reduction Coefficient: NRC 0.55.
  - 3. Ceiling Sound Transmission Class: CSTC 35.
  - 4. Edge Detail: Square.
  - 5. Size: 24 inches by 24 inches by 5/8-inch.
- C. Products: Subject to compliance with requirements, provide one of the following, or approved substitute. Basis of design: #756A Armstrong.
  - 1. "Hytone Baroque", Celotex Corp.
  - 2. "Radar", USG Interiors, Inc.
  - 3. "Baroque", Certain Teed Corporation

#### 2.3 CEILINGS OF VINYL FACED GYPSUM PANELS

- A. Panel Characteristics: Type III units per ASTM E 1264 impact and soil resistant and complying with pattern and other requirements indicated.
  - 1. Approval: USDA approved for food service areas
  - 2. Pattern: Embossed stipple
  - 3. Color/Light Reflectance Coefficient: White/LR-1
  - 4. Noise Reduction Coefficient: NA
  - 5. Ceiling Sound Transmission Class: CAC 40-50

6. Edge Detail: Square
7. Thickness: ½ inch
8. Size: 24 by 24 inches (610 by 610 mm)

B. Suspension System Type: As described below and specified in Part 2 "Non-Fire-Resistance-Rated, Direct-Hung Suspension Systems" Article:

1. Wide-faced, aluminum-capped, double-web, hot-dip galvanized-steel suspension system.
2. Coordinate suspension system with other trades. No wire supports shall pass through the building's cable tray system.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Standard for Metal Suspension Systems: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.
- B. Finishes and Colors: Provide manufacturer's standard factory-applied finish for type of system indicated.
- C. Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.
- D. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.
  1. Gage: Provide wire sized so that stress at 3 times hanger design load (ASTM C 635, Table 1, Direct-Hung), will be less than yield stress of wire, but provide not less than 0.106-inch diameter (12 gage).
- E. Edge Moldings and Trim: Manufacturer's standard molding for edges and penetrations of ceiling which fits with type of edge detail and suspension system indicated.

2.5 NON-FIRE-RESISTANCE-RATED DIRECT-HUNG SUSPENSION SYSTEMS

- A. Wide-Face Capped Double-Web Steel Suspension System: Main and cross-runners roll-formed from prepainted or electrolytic zinc-coated cold-rolled steel sheet, with prefinished 15/16-inch-wide metal caps on flanges; other characteristics as follows:
  1. Structural Classification: Intermediate-Duty System.
  2. End Condition of Cross-Runners: Override (stepped) or butt-edge type, as standard with manufacturer.
  3. Cap Material and Finish: Steel sheet painted white.
- B. Manufacturer: Subject to compliance with requirements, provide products of one of the following, or approved substitute:
  1. Armstrong World Industries, Inc.
  2. Chicago Metallic Corporation.
  3. National Rolling Mills, Inc.
  4. USG Interiors, Inc.

2.6 MISCELLANEOUS MATERIALS

- A. Concealed Acoustical Sealant: Manufacturers standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and structural framing to which ceiling system attached or abuts for compliance with requirements specified in this and other sections that affect installation and anchorage of ceiling system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half-width units at borders, and comply with reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical ceiling systems to comply with installation standard referenced below, per manufacturer's instructions and CISCA "Ceiling Systems Handbook".
  - 1. Standard for Installation of Ceiling Suspension Systems: Comply with ASTM C 636.
- B. Arrange acoustical units and orient directionally patterned units in manner shown by reflected ceiling plans.
- C. Suspend ceiling hangers from building structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
  - 3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye-screws, or other devices that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  - 4. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  - 5. Space hangers not more than 4'-0" o.c. along each member supported directly from hangers, unless otherwise shown, and provide hangers not more than 8 inches from ends of each member.
- D. Install edge moldings of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical units.
  - 1. Sealant Bed: Apply continuous ribbon of acoustical sealant, concealed on back of vertical leg before installing moldings.
  - 2. Screw-attach moldings to substrate at intervals not over 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of 1/8 inch in 12'-0". Miter corners accurately and connect securely.
- E. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.

3.4 CLEANING

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SECTION 09511  
Acoustical Panel Ceilings

- A. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09511

**SECTION 09513 – ACOUSTICAL WALL SYSTEMS**

**PART 1 – GENERAL**

**1.1 DESCRIPTION:**

**A. Related Documents**

1. All of the drawings and general provisions of the Contract, including Section AB-Instructions to Proposers, Section AJ-General Conditions, Section AN-Supplementary Conditions, Sections AO-Special Conditions, and Sections 01030 through 01770 apply to the Work of this Section.

**B. This section covers the following types of architectural acoustical elements:**

1. Acoustical absorber wall panel.

**1.2 DEFINITIONS:**

- A. Noise Reduction Coefficient (NRC) rating refers to the arithmetic mean of the sound absorption coefficients in the one-third octave bands of 250, 500, 1000, and 2000 Hertz.**

**1.3 QUALITY ASSURANCE:**

- A. Manufacturer Qualifications:** To qualify for acceptance, an experienced firm in manufacturing acoustical panels similar to those indicated for this Project and with a record of successful in-service performance.
- B. Testing Agency Qualifications:** To qualify for acceptance, an independent testing agency must be qualified under the National Voluntary Laboratory Accreditation Program (NVLAP) of the U.S. Bureau of Standards and demonstrate to Architect's/Owner's satisfaction, based on evaluation of agency submitted criteria conforming to ASTM E548-94e1, that it has the experience and capability to conduct satisfactorily the testing indicated without delaying the Work.
- C. Fire-Test-Response Characteristics:** Provided acoustical panels shall have a Class "A" flame spread rating. Flame spread and smoke developed ratings shall be in accordance with ASTM E84-99. Products or their shipping cartons shall bear a label indicating flame spread and smoke developed ratings.
1. Flame Spread: 25 or less.
  2. Smoke Developed: 450 or less.
- D. Single-Source Responsibility for Acoustical Panels:** Obtain each type of acoustical panel from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- E. Installation shall be performed by a firm or entity authorized to install system and licensed to work as a general contractor or subcontractor, and shall demonstrate a minimum of three years successful experience in installations of acoustical panel systems.**

**1.4 PROJECT CONDITIONS:**

- A. Environmental Conditions:** Do not begin installation until spaces for acoustical panels have been enclosed and maintained at approximately the same humidity and temperature conditions as planned for occupancy. Maintain temperature and humidity as recommended by panel manufacturer.
- B. Air-Quality Limitations:** Protect acoustical panels from exposure to airborne odors, such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.



1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Protect acoustical panels from excessive moisture in shipment, storage, and handling. Deliver in unopened bundles and store in a dry place with adequate air circulation. Do not deliver material to building until wet-work, such as concrete and plaster, has been completed and cured to a condition of equilibrium. Protect panel edges from crushing and impact.

1.6 SUBMITTALS:

- A. Provide, at contractor's expense, samples for initial selection in 12-inch square units for each type of acoustical panel facing material required and in color, texture, and pattern selected.
- B. Provide manufacturer's product data for each type of acoustical panel specified including the following:
  - 1. Noise Reduction Coefficient (NRC) rating as tested in accordance to ASTM C423-99a from a qualified testing agency.
  - 2. Light reflectance data based upon final finish if required.
  - 3. Recommended procedures for normal cleaning and removal of stains. Include precautions in the use of cleaning materials that may be detrimental to surfaces.
  - 4. Installation details.
- C. Provide shop drawings showing fabrication and installation of acoustical panels including plans, elevations, sections, details of components, and attachments to other construction.
- D. Show orientation of panels including fabric selection, pattern matching, and seams.
- E. Indicate deviations, if any.
- F. Reproduction of design drawings shall not be used in the preparation of shop drawings.
- G. Submittals not specifically required, or not complying with the format requirements, will be returned unreviewed.

PART 2 – PRODUCTS

2.1 GENERAL:

- A. Unless otherwise specified herein, quantities of equipment are indicated on the Drawings.
- B. Performance criteria or physical characteristics specified herein represent minimum acceptable values unless noted otherwise.
- C. Fabricate panels to exact sizes and configurations to suit specified material required to fit ceiling and/or wall surfaces based on field measurements of completed substrates indicated to receive acoustical panels.
- D. Dimensional Tolerances of Finished Units: Overall height and width of panels: Plus or minus 1/16 inch for the following:
  - 1. Thickness.
  - 2. Edge straightness.
  - 3. Overall length and width.
  - 4. Squareness from corner to corner.
  - 5. Chords, radii, and diameters.
- E. Basis of Design: Benton Brothers manufacturer's specific models indicated herein are to show design intent. Similar equipment by other manufacturers will be considered, provided deviations in dimensions and profiles are minor and the design intent is not compromised as judged by the Architect/Owner.

2.2 ACOUSTICAL ABSORBER WALL PANEL:

- A. General: Where indicated on drawings provide acoustical panels complying with the following panel characteristics:
  - 1. Overall panel thickness to be 2 1/8".
  - 2. Core composition material to be 2" thick 6-7 lb/cu. ft. density smooth molded fiberglass bonded to a 1/8" thick 16-20 lb/cu. ft. density molded fiberglass board for a high impact-resistant finish.
  - 3. Acoustical performance to have NRC rating of not less than 1.00.
  - 4. Mounting style to be "A".
  - 5. Mounting method to be consistent with permanently securing panels mechanically via a metal panel clip system designed to engage metal framing of panels and to allow removal of panels from substrate material, with base support brackets where recommended by manufacturer to support weight of panels.
  - 6. Panel size to conform as indicated on Drawings.
  - 7. Edge detail to be beveled.
  - 8. Corner detail to be square.
  - 9. Facing material to be Guilford FR-701 or approved COM standard woven polyester fabric. Finish fabric should be acoustically transparent. Coordinate colors, textures, and patterns with Architect.
  - 10. Manufacturer: Benton Brothers Solutions, Conwed, Decoustics, Essi Acoustical Products, Forbo Industries, MPC, Sound Reduction Corp., Sound-Tek, or Wenger.

PART 3 – EXECUTION

3.1 GENERAL:

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of acoustical panels. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Where existing acoustical treatment is damaged due to the new Work, repair damage to match existing work or replace damaged portion with conditions specified for new Work.

3.2 INSTALLATION:

- A. Install acoustical panels in locations indicated in schedules and on drawings with vertical surfaces and edges plumb, top edges levels and in alignment with other panels, scribed to fit adjoining work accurately at borders and at penetrations. Comply with manufacturer's written instructions for installation of panels using type of mounting method indicated or, if not indicated, as recommended by manufacturer.
- B. Remove and replace panels that are damaged and are unacceptable to Architect/Owner.

3.3 CLEANING:

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels, upon completion of installation, as recommended by manufacturer's written instructions.
- C. Remove surplus materials, rubbish, and debris resulting from acoustical panels' installation, upon completion of the Work, and leave area of installation in a neat and clean condition.

3.4 PROTECTION:

- A. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures that acoustical panels are without damage or deterioration at the time of Substantial Completion.

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SECTION 09513  
Acoustical Wall Systems

- B. Replace panels that cannot be cleaned and repaired, in a manner acceptable to the Architect/Owner, prior to the time of Substantial Completion.

END OF SECTION 09513

**SECTION 09650 - VINYL COMPOSITION FLOOR TILE**

**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. Vinyl composition floor tile. VCT
  - 2. Resilient wall base and accessories.

**1.3 SUBMITTALS**

- A. Product Data: For each type of product specified.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors and patterns available for each type of product indicated.
- C. Samples for Verification: Full-size tiles of each different color and pattern of resilient floor tile specified, showing the full range of variations expected in these characteristics.
  - 1. For resilient accessories, manufacturer's standard-size samples, but not less than 12 inches (300 mm) long, of each resilient accessory color and pattern specified.
- D. Maintenance Data: For resilient floor tile to include in the maintenance manuals specified in Division 1.

**1.4 QUALITY ASSURANCE**

- A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.
- B. Source Limitations: Obtain each type, color, and pattern of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
- B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 70 and 80 deg F.
- C. Store tiles on flat surfaces.
- D. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

**1.6 PROJECT CONDITIONS**

- A. Space Enclosure: Do not install tile until space is enclosed, conditioned, weatherproof, wet-work in space is completed and dry, work above ceilings is complete, and ambient conditions of temperature and humidity will be continuously maintained at values indicated for final occupancy.

Maintain a temperature of not less than 70 deg F or more than 80 deg F in spaces to receive products for at least 48 hours before installation, during installation, and continuously after installation, unless manufacturer's written recommendations specify longer time periods. Perform moisture test to satisfy manufacturers requirements.

- B. Do not install products until they are at the same temperature as the space where they are to be installed.
- C. Close spaces to traffic during flooring installation and for time period after installation recommended in writing by manufacturer.
- D. Install tiles and accessories after other finishing operations, including painting, have been completed.
- E. Do not install flooring over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive, as determined by flooring manufacturer's recommended bond and moisture test. Submit moisture test to Architect prior to installing tile.

#### 1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
1. Furnish two boxes for each of each type, color, pattern, class, wearing surface, and size of resilient tile flooring installed.
  2. Deliver extra materials to Owner.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the following:
- a. Armstrong World Ind.; Stonetex
  - b. Azrock Comercial Flooring, Domco; Thru-Quartz
  - c. Congoleum Corporation; Selections
- B. Tile Standard: ASTM F 1066, Class 2, Through-pattern tile.
- C. Wearing Surface; Smooth
- D. Thickness: 0.125 Inch.
- E. Size: 12" x 12"
- F. Colors and patterns; As selected by the Architect from manufacturers full range.
- G. Accent color tile shall be one of the following:
- a. Armstrong World Ind.; Feature tile
  - b. Azrock Comercial Flooring, Domco; Solids and Feature Strips
  - c. Congoleum Corporation; Special Effects
- H. All tile shall be from one manufacturer.
- B. VCT tile at areas subject to moisture shall be slip resistant:
- a. Armstrong Safety Zone VCT
  - b. Azrock Comercial Flooring, Domco; Equal product
  - c. Congoleum Corporation; Equal product

## 2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by flooring manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
- C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of tiles, and in maximum available lengths to minimize running joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
  - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by flooring manufacturer.
  - 2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving resilient flooring, then grind out all ridges and or apply leveling compounds that are approved by tile manufacturer to achieve a uniform, flat surface free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Do not proceed with installation until unsatisfactory conditions have been corrected.
- D. The Contractor shall provide written acceptance from the contractor installing the resilient tile flooring regarding acceptance of the condition of the slab-on-grade. All imperfections in the slab shall be corrected so that no translations will be evident in the finished tile.

### 3.2 PREPARATION

- A. General: Comply with resilient product manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates. Product must be approved by tile manufacturer and installer. Grind any high spots or ridges until the subfloor is flat.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- D. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.3 TILE INSTALLATION

- A. General: Comply with tile manufacturer's written installation instructions.
- B. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half of a tile at perimeter.
  - 1. Lay tiles square with room axis, unless otherwise indicated.
- C. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.
  - 1. Lay tiles in basket-weave pattern with grain direction alternating in adjacent tiles. Provide 2 colors in areas as indicated on the finish schedule.
- D. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- E. Extend tiles into toe spaces, door reveals, closets, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent, nonstaining marking device.
- G. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to comply with tile manufacturer's written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
  - 1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- H. Hand roll tiles according to tile manufacturer's written instructions.

### 3.5 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing resilient products:
  - 1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.
  - 2. Sweep or vacuum floor thoroughly.
  - 3. Do not wash floor until after time period recommended by flooring manufacturer.
  - 4. Damp-mop floor to remove marks and soil.
- B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period.
  - 1. Apply protective floor polish to floor surfaces that are free from soil, visible adhesive, and surface blemishes..
    - a. Coordinate selection of floor polish with Owner's maintenance service.
  - 2. Cover products installed on floor surfaces with undyed, untreated building paper until inspection for Substantial Completion.

3. Do not move heavy and sharp objects directly over floor surfaces. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.
- C. Clean floor surfaces not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Use cleaning products according to manufacturer's written recommendations.
1. Before cleaning, strip protective floor polish that was applied after completing installation only if required to restore polish finish and if recommended by flooring manufacturer.
  2. After cleaning, reapply polish to floor surfaces to restore protective floor finish according to flooring manufacturer's written recommendations. Coordinate with Owner's maintenance program.
  3. The final floor surface must have a minimum of two coats of floor polish. At substantial completion, the floors must be completely clean and ready to receive additional coats of polish by the Owner. Any required cleaning will be at the contractor's expense.
    - a. Polish shall be: Ecolab Gemstar Wax.

END OF SECTION 09651



**SECTION 09653 - RESILIENT BASE AND ACCESSORIES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Resilient base.
  - 2. Resilient stair accessories.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.6 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than **70 deg F (21 deg C)** or more than **95 deg F (35 deg C)** in spaces to receive resilient products during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Install resilient products after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 THERMOPLASTIC-RUBBER BASE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Allstate Rubber Corp.
  - 2. Armstrong World Industries, Inc.
  - 3. Johnsonite; A Tarkett Company.
  - 4. Mondo Rubber International, Inc.
  - 5. Roppe Corporation, USA.
- B. Product Standard: ASTM F 1861, Type TS rubber.
  - 1. Group: I - solid, homogeneous
  - 2. Style and Location:
    - a. Style, Cove (base with toe)
- C. Thickness: 0.125 inch
- D. Height: 4 inches. Match base height at locker bases.
- E. Lengths: Coils in manufacturer's standard length. Do not break continuous lengths of base run in spaces to receive cove base. Each span of wall shall receive one, unbroken length. No "piecing" is accepted.
- F. Outside Corners: Preformed
- G. Inside Corners: Job formed
- H. Colors: As selected by Architect from full range of industry colors.

### 2.2 RUBBER STAIR ACCESSORIES

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. Manufacturers: All resilient base accessories shall be by one manufacturer.
- C. Stair Treads: ASTM F 2169.
  - 1. Type: TS rubber
  - 2. Class: 2 pattern; raised disk.
  - 3. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees
  - 4. Nosing Height: 1-1/2 inches
  - 5. Thickness: 1/4 inch
  - 6. Size: Lengths and depths to fit each stair tread in one piece.
- D. Separate Risers: Smooth, flat; in height that fully covers substrate; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

1. Style: Smooth ,flat, toeless. Riser height varies, match existing.
2. Thickness: 0.125 inch

- E. Landing Tile: Matching treads; produced by same manufacturer as treads.
- F. Locations: At all intermediate landings and as shown.
- G. Colors and Patterns: As selected by Architect from full range of industry colors.

## 2.3 RUBBER MOLDING ACCESSORY

- A. Manufacturers: All resilient base accessories shall be by one manufacturer.
- B. Profile and Dimensions: To be selected from manufactures full line.
- C. Locations: At each transition between dissimilar flooring materials and at platform nosing.
- D. Colors and Patterns: As selected by Architect from full range of industry colors.

## 2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

## 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:
  - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft in 24 hours.
  - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until they are the same temperature as the space where they are to be installed.
  1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### 3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
  1. Inside Corners: Use straight pieces of maximum lengths possible.

### 3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Stair Accessories:
  - 1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
  - 2. Tightly adhere to substrates throughout length of each piece.
- C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

### 3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum horizontal surfaces thoroughly.
  - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09653

**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 designated in "schedules", except where a surface or material is specifically indicated not to be painted or is to remain natural. 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 Paints (PPG)
  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. PPG: 6-7 Speedhide Interior Exterior Latex Masonry Block Filler

#### 2.3 PRIMERS:

- A. Exterior Acrylic Primer : Exterior acrylic wood primer used for priming wood or gypsum board under a flat acrylic emulsion finish:
  1. PPG: 17-921 Seal Grip Interior Exterior Universal Acrylic 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. PPG: 17-921 Seal Grip Interior Exterior Universal Acrylic Primer.
  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. 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. PPG: 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. PPG: Amerlock 2 VOC High Build Epoxy..
  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. 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. DTM Water Borne Acrylic Semi Gloss Enamel: DTM Semi Gloss Acrylic paint for use over prime-coated ferrous or galvanized metal:
1. PPG: 4216HP DTM High Performance Waterborne Acrylic Semi Gloss.
  2. Glidden: 4216HP DTM High Performance Waterborne Acrylic Semi Gloss..
  3. S-W: DTM Acrylic Semi-Gloss, B66W211.
- C. Gloss Urethane Enamel: Urethane finish for ferrous metal handrails:
1. 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. 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. 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. Pre Catalyzed Semi Gloss Acrylic Epoxy: Paint system for use over concrete masonry block, with manufacturer's recommended primer:
1. PPG: 16-510 Pitt-Glaze WB1 Semi-Gloss Pre-Catalyzed WB Acrylic Epoxy.
  2. Glidden: 16-510 Pitt-Glaze WB1 Semi-Gloss Pre-Catalyzed WB Acrylic Epoxy..
  3. S-W: Pro Industrial PreCatalyzed Epoxy Semi Gloss, K46W151 Series.
- 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. PPG: 7-282 Industrial Oil Base Gloss Enamel.
  2. Glidden: 4308 Devguard Alkyd Gloss Enamel.
  3. S-W: Industrial Enamel B-54 Series.
- E. Concrete floor sealing for use in spaces indicated as "PC" floors in the Schedule of Finishes. Provide floor prep and primer as directed by manufacturer.
1. PPG: 4-4210XI Perma Crete Color Seal WB Interior/Exterior Concrete Stain .

## 2.6 MISCELLANEOUS WOOD FINISHING MATERIALS

- A. Satin Polyurethane: Clear polyurethane with satin finish for use over wood surfaces.
1. PPG: DFT259 Deft Interior/Exterior Polyurethane Water Based Satin 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. PPG: DFT61 Deft Sanding Sealer Interior Water Based
  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. PPG: DFT400 Deft Interior Oil Based 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.
  - 2. Concrete (Bare) – Interior – Concrete Stain (PC)
    - a. Surface Preparation: All concrete surfaces must be sound, clean, dry, cured, and profiled. All concrete surfaces shall be free of surface hardeners, form release agents, curing compounds, laitance, efflorescence, chloride contamination, hydrostatic water pressure or excessive capillary water action, and/or water vapor emission. All concrete surfaces shall be cleaned first with a strong detergent to remove oils, grease, dirt and any other contamination before proceeding with acid etching to achieve a porous and coatable surface.
- 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 surfaces visible when installed. 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. Exterior Flat Acrylic Emulsion:

- .1 Primer: Exterior Acrylic Primer
  - .2 First Coat: Exterior Flat Acrylic Emulsion
  - .3 Second Coat: Exterior Flat Acrylic Emulsion.
- 2. Ferrous Metal:
  - a. Exterior DTM Acrylic Semi Gloss Finish: 2 finish coats over primer.
    - .1 Primer: Synthetic Rust-Inhibiting Primer.
    - .2 First Coat: DTM Water Borne Acrylic Semi Gloss Enamel.
    - .3 Second Coat: DTM Water Borne Acrylic Semi Gloss Enamel.
- 3. Zinc-Coated Metal:
  - a. Exterior DTM Acrylic Semi Gloss Finish: 2 finish coats over primer.
    - .1 Primer: Galvanized Metal Primer.
    - .2 First Coat: DTM Water Borne Acrylic Semi Gloss Enamel.
    - .3 Second Coat: DTM Water Borne Acrylic Semi Gloss Enamel
- 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. Pre Catalyzed Semi Gloss Acrylic Epoxy
    - .1 Primer: High-Performance Epoxy Block Filler
    - .2 First Coat: Pre Catalyzed Semi Gloss Acrylic Epoxy
    - .4 Second Coat: Pre Catalyzed Semi Gloss Acrylic Epoxy
- 2. Gypsum Drywall Systems:
  - a. Pre Catalyzed Semi Gloss Acrylic Epoxy: 2 finish coats over primer, at exposed gypsum drywall.
    - .1 Primer: 100% Acrylic Interior Primer.
    - .2 First Coat: Pre Catalyzed Semi Gloss Acrylic Epoxy.
    - .3 Second Coat: Pre Catalyzed Semi Gloss Acrylic Epoxy.
  - 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.
- 5. Exposed Concrete Floors: (PC)
  - .1 Primer Coat: PPG Perma Crete Concrete Stain
  - .2 Finish Coat: PPG Perma Crete Concrete Stain

END OF SECTION 09900

**SECTION 10100 - VISUAL DISPLAY BOARDS**

**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 Visual Display Boards. Provide and install all miscellaneous items, appurtenances and devices, incidental to or necessary for a sound, secure, and complete system.

**1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Porcelain enamel markerboards.
  - 2. Vinyl-fabric-faced cork tackboards.

**1.3 SUBMITTALS**

- A. Shop Drawings: For each type of visual display board required.
  - 1. Include dimensioned elevations. Show location of joints between individual panels where unit dimensions exceed maximum panel length.
  - 2. Include sections of typical trim members.
  - 3. Show anchors, grounds, reinforcement, accessories, layout, and installation details.
- B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors and textures available for the following:
  - 1. Porcelain Enamel Markerboards: Actual sections of porcelain enamel finish for each type of markerboard required.
  - 2. Vinyl-Fabric-Faced Cork Tackboards: Fabric swatches for each type of vinyl-fabric-faced cork tackboard indicated.

**1.4 QUALITY ASSURANCE**

- A. Fire-Test-Response Characteristics: Provide vinyl-fabric-faced tackboards with the following surface-burning characteristics as determined by testing assembled materials composed of facings and backings identical to those required in this Section per ASTM E 84 by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify vinyl-fabric-faced tackboards with appropriate markings of applicable testing and inspecting agency.
  - 1. Flame Spread: 25 or less.
  - 2. Smoke Developed: 10 or less.

**1.5 PROJECT CONDITIONS**

- A. Field Measurements: Verify field measurements before preparation of Shop Drawings and before fabrication to ensure proper fitting. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.



2. Space Enclosure: Do not install marker boards and tack boards until space is enclosed, conditioned, weatherproof, wet-work in space is completed and dry, work above ceilings is complete, and ambient conditions of temperature and humidity will be continuously maintained at values indicated for final occupancy.

#### 1.6 WARRANTY

- A. Porcelain Enamel Markerboard Warranty: Submit a written warranty executed by manufacturer agreeing to replace porcelain enamel markerboards that do not retain their original writing and erasing qualities, become slick and shiny, or exhibit crazing, cracking, or flaking within the specified warranty period, provided the manufacturer's written instructions for handling, installation, protection, and maintenance have been followed.

1. Warranty Period: 50 years from date of Substantial Completion.

### 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. Porcelain Enamel Markerboards:
    - a. American Chalkboard
    - b. Best-Rite Chalkboard Co.
    - c. Carolina Chalkboard Co.
    - d. Claridge Products and Equipment, Inc.
    - e. Greensteel, Inc.
    - f. Lemco, Inc.
    - g. Marsh Chalkboard Company.
    - h. Nelson Adams Company.
    - i. Newline Products, Inc.
    - j. American Visual Display Products
  2. Tackboards:
    - a. American Chalkboard
    - b. Best-Rite Chalkboard Co.
    - c. Carolina Chalkboard Co.
    - d. Claridge Products and Equipment, Inc.
    - e. Greensteel, Inc.
    - f. Lemco, Inc.
    - g. Marsh Chalkboard Company.
    - h. Nelson Adams Company.
    - i. Newline Products, Inc.
    - j. American Visual Display Products

#### 2.2 MATERIALS

- A. Porcelain Enamel Markerboards: Balanced, high-pressure-laminated, porcelain enamel markerboards of 3-ply construction consisting of face sheet, core material, and backing.
  1. Face Sheet: 0.024-inch (0.61-mm) enameling grade steel especially processed for temperatures used in coating porcelain on steel. Coat exposed face and edges with a 3-coat process consisting of primer, ground coat, and color cover coat. Coat concealed face with a 2-coat process consisting of primer and ground coat. Fuse cover and ground coats to steel at manufacturer's standard firing temperatures, but not less than 1200 deg F (649 deg C).

- a. Cover Coat: Provide manufacturer's standard, light-colored, special writing surface with gloss finish intended for use with erasable dry markers.
  2. Core: 1/2-inch- (9.5-mm-) thick, particleboard core material complying with requirements of ANSI A208.1, Grade 1-M-1.
  3. Backing Sheet: 0.015-inch-(0.38-mm-) thick, aluminum-sheet backing.
  4. Laminating Adhesive: Manufacturer's standard, moisture-resistant, thermoplastic-type adhesive.
- B. Vinyl-Fabric-Faced Tackboards: Mildew-resistant, washable vinyl fabric complying with FS CCC-W-408, Type II, weighing not less than 13 oz./sq. yd. (440 g/sq. m), laminated to 1/4-inch- (6.4-mm-) thick cork sheet. Provide fabric with a flame-spread rating of 25 or less when tested according to ASTM E 84. Provide color and texture as scheduled or as selected from manufacturer's standards.
1. Backing: Factory laminate cork face sheet under pressure to 1/4-inch- (6.4-mm-) thick hardboard backing.

## 2.3 ACCESSORIES

- A. Metal Trim and Accessories: Fabricate frames and trim of not less than 0.062-inch- (1.57-mm-) thick, extruded-aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units. Keep joints to a minimum. Miter corners to a neat, hairline closure.
1. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.
  2. Marker Tray: Manufacturer's standard, continuous, solid, extrusion-type, aluminum marker tray with ribbed section and smoothly curved exposed ends for each markerboard.
  3. Map Rail: Furnish map rail at top of each unit, complete with the following accessories:
    - a. Display Rail: Provide continuous cork display rail approximately 1 or 2 inches (25 or 50 mm) wide, as indicated, integral with map rail.
    - b. End Stops: Provide one end stop at each end of map rail.
    - c. Map Hooks: Provide 2 map hooks for every 48 inches (1220 mm) of map rail or fraction thereof.
    - d. Flag Holder: Provide one flag holder for each room.
  4. Marker boards in the music rooms shall have 4' wide full height staves.

## 2.4 FABRICATION

- A. Porcelain Enamel Markerboards: Laminate facing sheet and backing sheet to core material under pressure with manufacturer's recommended flexible, waterproof adhesive.
- B. Assembly: Provide factory-assembled chalkboard and tackboard units, unless field-assembled units are required.
1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
  2. Provide manufacturer's standard vertical joint system between abutting sections of chalkboards.
  3. Provide manufacturer's standard mullion trim at joints between chalkboards and tackboards.

## 2.5 FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

- B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- C. 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 wall surfaces, with Installer present, for compliance with requirements and other conditions affecting installation of visual display boards.
  - 1. Surfaces to receive markerboards shall be free of dirt, scaling paint, and projections or depressions that would affect smooth, finished surfaces of markerboards.
  - 2. Surfaces to receive tackboards shall be dry and free of substances that would impair the bond between tackboards and substrate.
  - 3. Do not proceed with installation until unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Deliver factory-built visual display boards completely assembled in one piece without joints, where possible. If dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, pre-fit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.
- B. Install units in locations and at mounting heights indicated and according to manufacturer's written instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- C. Coordinate Project-site-assembled units with grounds, trim, and accessories. Join parts with a neat, precision fit.

#### 3.3 ADJUSTING AND CLEANING

- A. Verify that accessories required for each unit have been properly installed and that operating units function properly.
- B. Clean units according to manufacturer's written instructions.

END OF SECTION 10100

SECTION 10155 - TOILET COMPARTMENTS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Fiberglass reinforced polyester (FRP), floor supported, overhead-braced partitions.

**1.2 RELATED SECTIONS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. See drawings for type and style of partitions required in each toilet.

**1.3 REFERENCES**

**1.4 PERFORMANCE REQUIREMENTS**

- A. Surface Burning Characteristics, FRP Panels, ASTM E 84:
  - 1. Flame Spread: Maximum of 200, Class C.
  - 2. Smoke Developed: Maximum of 450, Class C.
- B. Surface Burning Characteristics, Class A Option FRP Panels, ASTM E 84:
  - 1. Flame Spread: Maximum of 25.
  - 2. Smoke Developed: Maximum of 450
- C. Water Absorption, FRP Doors and Panels, Nominal Value, ASTM D 570: 0.16 percent after 24 hours.
- D. Abrasion Resistance, Face Sheet, Taber Abrasion Test, 25 Cycles at 1,000 Gram Weight with CS-17 Wheel: Maximum of 0.01 average weight loss percentage.
- E. Stain Resistance, ASTM D 2299: Face sheet unaffected after exposure to red cabbage, tea, mustard, and tomato acid. Stain removed easily with mild abrasive or FRP cleaner when exposed to crayon and crankcase oil.
- F. Chemical Resistance, ASTM D 543. Excellent rating.
  - 1. Acetic acid, Concentrated.
  - 2. Ammonium Hydroxide, Concentrated.
  - 3. Citric Acid, 10%.
  - 4. Formaldehyde.
  - 5. Hydrochloric Acid, 10%
  - 6. Sodium hydroxide, 4 to 6 percent solution.
- G. Compressive Strength, Foam Core, Nominal Value, ASTM D 1621: 79.9 psi.
- H. Compressive Modulus, Foam Core, Nominal Value, ASTM D 1621: 370 psi.
- I. Tensile Adhesion, Foam Core, Nominal Value, ASTM D 1623: 45.3 psi.
- J. Thermal and Humid Aging, Foam Core, Nominal Value, 158 Degrees F and 100 Percent Humidity for 14 Days, ASTM D 2126: Minus 5.14 percent volume change.

**1.5 SUBMITTALS**

- A. Comply with Section 01330 (01 33 00) - Submittal Procedures.
- B. Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, finishes, and installation.
- C. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details, indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, hardware schedule, and finish.
- D. Samples:
  - 1. Panels: Submit manufacturer's sample of panels showing face sheets and core.
  - 2. Color: Submit manufacturer's samples of standard colors.
- E. Warranty: Submit manufacturer's standard warranty.

## **1.6 QUALITY ASSURANCE**

- A. Manufacturer's Qualifications:
  - 1. Continuously engaged in manufacturing panels of similar construction to that specified, with a minimum of 25 years successful experience.
  - 2. Evidence of a compliant documented quality management system.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying unit mark and manufacturer.
- B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
- C. Handling: Protect materials and finish from damage during handling and installation.

## **1.8 WARRANTY**

- A. Warrant panels and factory hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal wear and tear.
- B. Warranty Period: Ten years starting on date of shipment.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURER**

- A. Special-Lite, Inc.
- B. Bobrick Washroom Equipment, Inc.
- C. Bradley Corporation

### **2.2 Mounting Configurations**

- A. Toilet Partitions shall be floor mounted, overhead-braced.
- B. Urinal Screens shall be wall hung with full height "T" brackets.
  - 1. Included: 6" leg stand-off pilaster.

### **2.3 MATERIALS**

- A. Aluminum Members:

1. Aluminum extrusions made from prime-equivalent billet that is produced from 100% reprocessed 6063-T6 alloy recovered from industrial processes: ASTM B 221.
  2. Alloy and Temper: As required by manufacturer for strength, corrosion resistance, application of required finish, and control of color.
- B. FRP: .090" standard with pebbled finish.
- C. Fasteners:
1. Material: Aluminum, 18-8 stainless steel, or other noncorrosive metal.
  2. Compatibility: Compatible with items to be fastened.
  3. Exposed Fasteners: Screws with finish matching items to be fastened. Heads to be security type torx and pin.
- D. Latch: Sliding latch to be thru bolted to doors.
- E. Hinges: Select Continuous Hinge installed with thru bolts on door and pilaster.
- a. Manufacturer's standard self-closing type that can be adjusted to hold door open at any angle up to 90 degrees.
- F. Mounting Brackets: Full height aluminum brackets. Panels shall be thru bolted to brackets.
1. Standard: Full height aluminum "U" bracket.
- G. Pilaster Shoes: 4" anodized aluminum.
- H. Headrail: Extruded anodized aluminum with anti-grip profile.
- I. Coat hook / doorstop: Installed on all in swing doors. Out swing doors to have door pull installed.

## **2.4 FABRICATION**

- A. Panels, Pilasters, Doors: Aluminum perimeter channel with FRP face sheets. Core to be poured in place urethane foam. All panels and pilasters to be 1 1/4" thick.
- B. Panel Size: 58" tall by 59" wide standard. Panels can be produced up to 72" wide.
- C. Door Size: 24" and 36" door opening sizes are standard.
- D. Pilaster Size: 80" tall is standard. Width starts at 4" and goes up in 1" increments up to 12". Above 12" widths in 2" increments up to 24".

## **2.10 ALUMINUM FINISHES**

- A. Anodized Finish: Class I finish, 0.7 mils thick. Clear 215 R1, AA-M10C12C22A41.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas to receive partitions for correct dimensions, plumbness of walls, and soundness of surfaces that would affect installation of mounting brackets. Notify Architect of conditions that would adversely affect installation or subsequent use.
- B. Verify spacing of plumbing fixtures to assure compatibility with installation of partitions.
- C. Do not proceed with installation until unsatisfactory conditions are corrected.

**3.2 INSTALLATION**

- A. Install partitions rigidly, straight, plumb, and level and in accordance with installation instructions.
- B. Maintain uniform clearance at vertical edge of doors.

**3.3 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for installation of partitions.

**3.5 ADJUSTING**

- A. Adjust doors, hinges, and locksets for smooth operation without binding.

**3.6 CLEANING**

- A. Clean partitions promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that would damage finish.

**END OF SECTION**

## **SECTION 10425 - SIGNS**

### **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 types of signs:

1. Interior Engraved Plastic Signage.
2. Exterior Cast Aluminum Signage.

#### **1.3 SUBMITTALS**

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
  1. Provide message list for each sign required, including large-scale details of wording and lettering layout.
  2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed.
  3. Furnish full-size rubbings for metal plaques.

#### **1.4 QUALITY ASSURANCE**

- A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.
- B. Design Concept: The Drawings indicate sizes, profiles, and dimensional requirements of signs and are based on the specific types and models indicated. Sign units by other manufacturers may be considered provided deviations in dimensions and profiles do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURERS:**

- A. Exterior Signage shall be as manufactured by A. R. K. Ramos. Products by Andco Industries, Leeds Aluminum Letters, Metal Arts, Multi-graphics, Inc., Henry Graphics, Mills Aluminum Letters, and Serigraphics Sign Systems, Inc. meeting the requirements of these specifications are acceptable.



- B. Interior Signage shall be as manufactured by Best Manufacturing Sign System. Products by Andco Industries, Mohawk Sign Systems, American Graphics, Inc., Multi-graphics, Inc., Henry Graphics, ASI Sign Systems, Inc., Bayuk Graphic Systems, Inc. and Serigraphics Sign Systems, Inc. meeting the requirements of these specifications are acceptable.

## 2.2 MANUFACTURED UNITS

- A. Exterior Signage:
1. Exterior signage shall be cast aluminum, projected mounted with collars and threaded studs set in adhesive.
  2. Letter style shall be Futura No. 501, sizes and heights as indicated on drawings, as manufactured by A. R. K. Ramos Architectural Signage System.
  3. Finish to be a Kynar Finish that meets requirements of Metal Roofing Section 07411.
- B. Interior Signage:
1. Interior signage system shall as shown on drawings.
  2. Signage shall be mounted with vinyl foam mounting tape.

## PART 3 - EXECUTION

### 3.1 ACCEPTABLE INSTALLERS

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

### 3.2 PREPARATION

- A. Surface Conditions: Examine the areas and conditions under which work of this Section will be performed. Clean surfaces to receive signage until free of all dirt and oil, which could hinder adhesion of signage. Do not proceed until unsatisfactory conditions are corrected.

### 3.3 INSTALLATION

- A. Install the work of this Section in strict accordance with the manufacturers' recommendations as approved by the Architect, using only the approved mounting materials, and locating all components firmly into position, level and plumb.
- B. Provide solid wood blocking in metal framing for anchorage of letters. Collar shall extend through installation system and shall have minimum 1/4" sealant joint between collar veneer.
- C. Location:
1. All interior signage shall be wall mounted adjacent to the latch side of doors or nearest adjacent wall. Mounting height shall be 60" above the finished floor to the centerline of the sign.
  2. Exterior signage shall be located as indicated on drawings.
  3. The Owner shall approve location of plaque.

### 3.4 SCHEDULE

1. Provide at each entrance to each room. See also drawings for further locations.

END OF SECTION 10425

**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 as shown on drawings.
- C. K-type. Provide two K-type extinguishers for the kitchen area. Locate with Owner/Architect.

## 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).
    - a. 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.
  - b. Cabinets in gymnasium shall have solid doors without glazing.

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 the cabinet so that the handle is at 48" to center.
  - 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 10530 - PROTECTIVE COVERS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Extent of section includes all labor and materials to provide a complete walkway cover system per manufacturers specifications.
- B. Furnish all labor, materials, tools, equipment and services for Protective Covers. Provide and install all miscellaneous items, appurtenances and devices, incidental to or necessary for a sound, secure and complete system.

#### **1.2 SUBMITTALS**

- A. Product Data: Submit manufacturer's literature and installation instructions.
- B. Shop Drawings: Submit shop drawings showing layout, attachment method, and details.
  - 1. Where installed products are indicated to comply with certain structural design loadings, include structural computations, material properties, and other information needed for structural analysis which has been prepared and sealed by a qualified professional engineer licensed to practice in the jurisdiction where units will be installed.
  - 2. Indicate reactions to be transferred to supporting structure.
- C. Reference Section 01330-Submittal Procedures; submit following items:
  - 1. Product data.
  - 2. Shop Drawings: Layout and erection drawings showing roof framing, deck panels, cross sections and trim details clearly indicating proper assembly.
  - 3. Samples: Color selection samples consisting of actual coating material or anodizing process on aluminum extrusions.
  - 4. Quality Assurance/Control Submittals:
    - a. Qualifications: Letter certifying manufacturer's required qualifications.
    - b. Manufacturer's Installation Instructions.

#### **1.4 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Obtain protective cover system components from a single manufacturer with not less than 5 years of production experience, whose published literature indicates compliance with requirements of this section.

#### **1.5 PROJECT CONDITIONS**

- A. Field Measurements: Check actual locations of construction to which protective covers must fit by accurate field measurements before fabrication; show measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.
- B. Where field measurements cannot be made without delaying the work, guarantee dimensions and proceed with fabrication. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, and handle material in accordance with the manufacturer's instructions, and to prevent damage. Discard damaged components.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. These specifications are based on Perfection Architectural Systems. Products by Peachtree Protective Covers and Mitchell Metals and Tennessee Valley Metals shall also be acceptable.

### 2.2 MATERIALS

- A. Aluminum Extrusions: 6063 alloy, T-6 temper.
- B. Grout: 1 part Portland cement, 3 parts masonry sand; 2,000 psi (13.8 MPa) compressive strength.
- C. Foam Block-Outs: Rigid foam blocks sized as required for column embedment depth and shape.

### 2.3 COMPONENTS

- A. Columns:
  - 1. 6" x 6" Radius-cornered aluminum tubular.
  - 2. Grout Key: Provide two 1-½ inch (38 mm) diameter holes in column base, one each in opposite sides.
  - 3. Provide clear acrylic protection coat on surfaces in contact with grout.
- B. Beams: 6" x 6" Open top aluminum tubular extrusions as confirmed by structural engineering design.
- C. Deck: 3" x 6" x .060" Rigid-Roll-Lock extruded aluminum, self-flashing, interlocking as confirmed by structural engineering design.
  - 1. Provide welded endplate water dams where sections terminate at other than drainage channels.
- D. Fascia: Provide manufacturer's 4" x 7" x .094" extruded aluminum fascia and gutter sections as required to complete the installation resulting in a neat finished appearance.
- E. Flashing: Aluminum sheet, thickness as recommended by manufacturer for specific condition.
- F. Struts: 1 ½" x 1 ½" x .100" extruded aluminum tube.

### 2.4 ACCESSORIES

- A. Fasteners:
  - 1. Deck Screws: No. 14 x 1 inch (25 mm), self-tapping, Type 18-8 stainless steel with neoprene washer.
  - 2. Trim Screws: No. 10 x ½ inch (13 mm), self-tapping, Type 18-8 stainless steel.

### 2.5 FABRICATION

- A. Shop Assembly: Fabricate cross beams and columns into one piece rigid bents with corners mitered and heli-arc welded to the extent that completed bents can be shipped on local, state and federal highways without special permit. Provide bolted connections for bents that are required to be shipped unassembled.

2.6 FINISH

- A. Finish all components with Fluoropolymer Coating: 70 percent PVDF resin based fluoropolymer, AA-C-12C-42R-1, custom color as selected by architect, comply with AAMA 605.
  - 1. Three coat application.

**PART 3 - EXECUTION**

3.1 EXAMINATION

- A. Examine footings in which bents will be set [and building surfaces to which canopy will connect]. Verify footing locations and elevations comply with shop drawings.
- B. Coordinate with responsible entity to perform corrective work on unsatisfactory footings or surfaces.
- C. Commencement of work by installer is acceptance of existing conditions.

3.2 ERECTION

- A. Erect canopy in accordance with manufacturer's installation instructions.
- B. Set bents plumb, straight and true to line, adequately braced to maintain position until grout has cured.

3.3 CLEANING

- A. Clean surfaces soiled by work as recommended by manufacturer.
- B. Remove surplus materials and debris from the site.

3.4 PROTECTION

- A. Protect finished aluminum surfaces from damage due to subsequent operations through final acceptance by the Owner.

END OF SECTION 10530



## **SECTION 10670 - METAL STORAGE SHELVING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. General Requirements: Refer to the General Conditions, the Supplementary General Conditions and Division 1, all provisions of which apply to work under this section as if written in full herein.
- B. Furnish all labor, materials, tools, equipment and services for Pre-finished metal shelving. Provide and install all miscellaneous items, appurtenances and devices, incidental to or necessary for a sound, secure, and complete system.

#### **1.2 SUBMITTALS**

- A. Product Data: Submit manufacturer's literature for all items specified herein. Indicate material type, finish and sizes.

### **PART 2 – PRODUCTS**

#### **2.1 METAL STORAGE SHELVING**

##### **A. MANUFACTURERS:**

- 1. Specifications based on Lyon Metal Shelving. Products by Republic Storage Systems, List Industries and Penco Products meeting the requirements of these specifications will be acceptable.

##### **B. COMPONENTS**

- 1. General: Shelving shall be 84" tall open metal shelving system with factory-applied finish. Shelving shall be as widths and lengths indicated on drawings.
  - a. Posts: 16 Ga. "T" Post design, open style. All posts shall be punched for clip or nut and bolt construction. Shelves and accessories are to be vertically adjustable on 1½" centers max. Side sway braces or side panels to be attached to the side flange of the post. Bolts, nuts, and sway braces or panels shall not obstruct the full adjustability of the shelves.
- 2. Sway Braces: To be 12 gauge x ¾" steel punched at each end for bolting to posts and at the center for strength and ease of assembly – open style.
- 3. Shelf Clip: One-piece 12 gauge rugged compression type to insert into either box or offset angle posts for form a positive four-point connection. Clips shall have one claw-like hooks to seat firmly into post slots and two taps at bottom to seat into postholes for a tight friction connection. All clips for all posts and shelves to be the same. Design shall offer a pre-clipping feature to simplify erection. Finish: zinc plated. All shelves are to have four independently adjustable clips.
- 4. Shelves: Shall be 18 gauge steel with a 1-3/16" vertical face on all four sides, front and rear faces to have 17/32" return flange 90 degree with the edges coined upward to prevent snagging. Sides to have a 5/8" return flange 90 degree. All four-shelf corners shall be closed by lapping and spot welding together to provide a firm, rigid shelf. Shelf shall be universally punched for use with all available accessories and for clip or bolted assembly. All 36" wide shelves to be 18 Ga. Flange type. All 48" wide shelves to be 18 Ga. Box type. All units to have 7 shelves.
- 5. Foot Plates: Shall be 13-gauge zinc plated steel and be used to protect floors.

6. Finish: All painted parts shall be selected from a minimum of five standard colors. Materials shall be cleaned and phosphatized in a multi-stage process, dried in a 400 degrees oven and electrostatically spray painted with a high grade enamel and baked on at 360 degrees.

## 2.2 METAL WIRE SHELVING

### A. MANUFACTURERS:

1. Provide dry storage shelving, model BR Series\*C013, Super Erecta, manufactured by InterMetro Industries Corp. Provide shelving with standard finish and accessories necessary to insure complet installation. Products manufactured by Nexel and ISS, Inc., and modified to comply with specifications, are acceptable.

### B. COMPONENTS

1. Provide unit with the following:
  - a. Adjustable shelves, plastic split type sleeves.
  - b. 4BR Series posts, 86-5/8 inches high.
  - c. 5 tiers high.
  - d. End caps and adjustable feet.
  - e. All sections to be free standing.
  - f. Length and width to be as shown on Drawings.
  - g. Post clamp, model number 99942, where shelving is mounted back to back.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protection: Protect pre-finished surfaces from damage or staining during installation. Protect shelving until acceptance by Owner.

### 3.2 INSTALLATION

- A. Assemble and install metal shelving in accordance with manufacturer's recommendations. Install units plumb and level.
- B. Attach assembled units together at 72" above finish floor into runs and intersections as indicated. Use spacers as required between adjacent units. Install adjustable shelving in continuous runs equally spaced.
- C. Where shelving units are located against walls, attach to wall with a minimum of two ¼" diameter phillips head galvanized toggle bolts per unit. Locate attachments for each unit at rear post and at not less than 72 above finish floor.
- D. Exercise care not to damage adjacent construction and surfaces.

### 3.3 CLEANING

- A. Clean-up: Clean all metal surfaces prior to Substantial Completion. Touch-up metal surfaces and deliver one pint of touch-up paint to owner for his use.

END OF SECTION 10670

**SECTION 10801 - TOILET AND BATH ACCESSORIES**

**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. Toilet and bath accessories.
  - 2. Underlavatory guards.
- B. Related Sections include the following:
  - 1. Division 10 Section "Toilet Compartments" for compartments and screens.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessory Schedule and room designations indicated on Drawings.
- C. Maintenance Data: For accessories to include in maintenance manuals specified in Division 1. Provide lists of replacement parts and service recommendations.

1.4 QUALITY ASSURANCE

- A. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.
  - 1. Other manufacturers' products with equal characteristics may be considered. See Division 1 Section "Substitutions."
  - 2. Do not modify aesthetic effects, as judged solely by Architect, except with Architect's approval. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.5 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering accessories that may be incorporated into the Work include, but are not limited to, the following:
1. Toilet and Bath Accessories:
    - a. American Specialties, Inc.
    - b. Bobrick Washroom Equipment, Inc.
    - c. Bradley Corporation.
    - d. General Accessory Manufacturing Co. (GAMCO).
  2. Underlavatory Guards:
    - a. Plumberex, Inc.
    - b. Truebro, Inc.
    - c. TCI
- B. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the Toilet and Bath Accessory Schedule as shown on drawings.

### 2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.
- B. Brass: ASTM B 19, leaded and unleaded flat products; ASTM B 16 (ASTM B 16M), rods, shapes, forgings, and flat products with finished edges; ASTM B 30, castings.
- C. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch (0.9-mm) minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.
- D. Galvanized Steel Sheet: ASTM A 653/A 653M, G60 (Z180).
- E. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.
- F. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- G. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

### 2.3 FABRICATION

- A. General: Names or labels are not permitted on exposed faces of accessories. On interior surface not exposed to view or on back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.
- B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.

- C. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.
- D. Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation with concealed fasteners.
- E. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.
- C. Install grab bars to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

#### 3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10801

## SECTION 12241 - ROLLER WINDOW SHADES

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Manually operated roller shades with single rollers.
2. Provide all components necessary for a fully operational system.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
- C. Samples: For each exposed product and for each color and texture specified.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Product test reports.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain roller shades from single source from single manufacturer.

## 2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Draper Inc.
  - 2. Hunter Douglas Contract.
  - 3. Insolroll Window Shading Systems.
- B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
  - 1. Chain-Retainer Type: Chain tensioner, jamb mounted
  - 2. Spring Lift-Assist Mechanisms: Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criterion is more stringent.
- C. Rollers: Extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
  - 1. Roller Drive-End Location: Right side of interior face of shade
  - 2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
- F. Shadebands:
  - 1. Shadeband Material: Light-filtering fabric.
  - 2. Shadeband Bottom (Hem) Bar: Extruded aluminum.
    - a. Type: Enclosed in sealed pocket of shadeband material
    - b. Color and Finish: As selected by Architect from manufacturer's full range
- G. Installation Accessories:
  - 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
  - 2. Endcap Covers: To cover exposed endcaps.
  - 3. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.
  - 4. Installation Accessories Color and Finish: As selected from manufacturer's full range

## 2.3 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701 Class A. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
  - 1. Source: Roller shade manufacturer.
  - 2. Type: Woven PVC-coated polyester
  - 3. Weave: Basketweave
  - 4. Thickness: Manufacturer's highest quality
  - 5. Weight: Manufacturer's highest quality.
  - 6. Roll Width: 60 inches
  - 7. Orientation on Shadeband: Up the bolt
  - 8. Openness Factor: As Selected by Architect.
  - 9. Color: As selected by Architect from manufacturer's full range.

## 2.4 ROLLER SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
  - 1. Between (Inside) Jamb Installation: Total width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch. Entire window shall be covered with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings. Units may span mullions not to exceed a total length of 10'-0".
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:
  - 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
  - 2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.



### PART 3 - EXECUTION

#### 3.1 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
  - 1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.
- B. Electrical Connections: Connect motor-operated roller shades to building electrical system.
- C. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
- D. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.
- E. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

#### 3.2 Schedule

- A. Install manually operated shades at all exterior windows.

END OF SECTION 12241

**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
  - 3. Habersham
  - 4. M&N Millwork

### 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, 0.018" 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 0.018" 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. 0.018" 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, 0.018" 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 0.018" 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 0.018" 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 (3/4" thick if less than 36" long, 1" thick if 36" long or above) 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 Best Core IC Locks to receive the Owner's Best Core.
- 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 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.
- 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 1/2" thick inset with 3/4" thick hanging strips of 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 3/4" thick if less than 36" long, 1" thick if 36" long or above. 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 1/2" 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 integral backsplashes to have 90 degree postformed 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 13851 - FIRE ALARM

### 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

The fire alarm subcontractor shall be responsible for furnishing all labor, materials, conduit and cable installation, boxes, devices, etc. in his base price. Furnish and install wire guards over new devices. Submit point to point wiring diagram indicating proposed locations of devices.

**The fire alarm subcontractor shall expand/replace the existing fire alarm system with voice evacuation into the new building addition.**

Contractor shall expand/replace the existing system to add the new devices as indicated on the drawings and these specifications. Maintain existing system at all times. The additional equipment shall be compatible with the existing equipment. The contractor shall check the existing system (and the existing system in the other buildings on campus) and shall verify the complete operation of the system prior to making any modifications or relocating of equipment. The contractor shall provide written correspondence to the county indicating any problems that exist. The Owner shall have the option of contracting with a third party to repair any inoperative equipment, once the system has been verified to be completely operational, the contractor shall have complete responsibility for the system and shall repair any and all equipment that becomes damaged or inoperative prior to final acceptance by the county. Contractor shall maintain all devices and circuiting outside of the areas of renovations and that pass through and feed downstream devices.

The fire alarm subcontractor shall be responsible for furnishing all labor, materials, conduit and cable installation, boxes, devices, etc. in his base price. This Section includes fire alarm systems.

- A. Related Sections include the following:
  - 1. Division 8 Section "Door Hardware" for door closers and holders with associated smoke detectors, electric door locks, and release devices that interface with the fire alarm system.

#### 1.3 DEFINITIONS

- A. FACP: Fire alarm control panel.
- B. LED: Light-emitting diode.
- C. NICET: National Institute for Certification in Engineering Technologies.
- D. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

1.4 SYSTEM DESCRIPTION

- A. Noncoded, addressable system; multiplexed signal transmission dedicated to fire alarm service only.

1.5 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 72.
- B. Premises protection includes , UL labeled, conforming with NEMA, standard building code, and NFPA 101 standards for Assembly class "B" Occupancy (greater than 300 occupancy) and educational occupancy.
- C. Fire alarm signal initiation shall be by one or more of the following devices:
  - 1. Manual stations.
  - 2. Heat detectors.
  - 3. Smoke detectors.
  - 4. Verified automatic alarm operation of smoke detectors.
  - 5. Automatic sprinkler system water flow and tamper.
  - 6. Fire extinguishing system operation.
- D. Fire alarm signal shall initiate the following actions:
  - 1. Alarm notification appliances shall operate continuously.
  - 2. Identify alarm at the FACP[ and remote annunciators].
  - 3. Transmit an alarm signal to the remote alarm receiving station.
  - 4. Unlock electric door locks in designated egress paths.
  - 5. Release fire and smoke doors held open by magnetic door holders.
  - 6. Activate voice/alarm communication system.
  - 7. Record events in the system memory.
- E. Supervisory signal initiation shall be by one or more of the following devices or actions:
  - 1. Operation of a fire-protection system valve tamper.
- F. System trouble signal initiation shall be by one or more of the following devices or actions:
  - 1. Open circuits, shorts and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
  - 2. Opening, tampering, or removal of alarm-initiating and supervisory signal-initiating devices.
  - 3. Loss of primary power at the FACP.
  - 4. Ground or a single break in FACP internal circuits.
  - 5. Abnormal ac voltage at the FACP.
  - 6. A break in standby battery circuitry.
  - 7. Failure of battery charging.
  - 8. Abnormal position of any switch at the FACP or annunciator.
  - 9. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.
- G. System Trouble and Supervisory Signal Actions: Ring trouble bell and annunciate at the FACP and remote annunciators.
- H. Furnish and install additional contacts in the main fire alarm panel for the owners energy management system to monitor, alarm, trouble and supervision. In addition, the system shall be provided with (3) spare contacts.

- I. System shall automatically suspend the Gym and Multipurpose sound systems during alarm conditions. Upon clearing of the fire alarm, these sound systems shall automatically reset and be fully functional. Interconnect to sound system shunt trip breakers in electrical room.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
  1. Shop Drawings shall be prepared by persons with the following qualifications:
    - a. Trained and certified by manufacturer in fire alarm system design.
    - b. Fire alarm certified by NICET, minimum Level III.
  2. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
  3. Device Address List: Coordinate with final system programming.
  4. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
  5. Wiring Diagrams: Power, signal, and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Show wiring color code.
  6. Batteries: Size calculations.
  7. Duct Smoke Detectors: Performance parameters and installation details for each detector, verifying that each detector is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
  8. Ductwork Coordination Drawings: Plans, sections, and elevations of ducts, drawn to scale and coordinating the installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, the detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
  9. Voice/Alarm Signaling Service: Equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
  10. Floor Plans: Indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

All cabling shall be run in conduit. Minimum size of raceway shall be 3/4" c. All systems cables shall be terminated with punch down blocks in a separate NEMA 1 enclosure. Under no circumstances shall the system cables be spliced with twist connectors behind a device or in a pull box. The Low Voltage Contractor (Intercom, Fire Alarm, Sound Systems) shall use a minimum of an 8" x 8" x 4" pull box to terminate all cables with the specified punch down blocks. Cables shall not be spliced in system pull boxes. Where cables are punched down in these boxes, the systems cables shall be properly labeled inside the box for system zone and equipment connections. All system cables shall be run in conduit.
- C. Qualification Data: For Installer.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For fire alarm system to include in emergency, operation, and maintenance manuals. Comply with NFPA 72, Appendix A, recommendations for Owner's manual. Include abbreviated operating instructions for mounting at the FACP.

F. Documentation:

1. Approval and Acceptance: Provide the "Record of Completion" form according to NFPA 72 to Architect.
2. Record of Completion Documents: Provide the "Permanent Records" according to NFPA 72 to Architect. Format of the written sequence of operation shall be the optional input/output matrix.
  - a. Hard copies on paper to Architect.
  - b. Electronic media shall be provided to Architect.
3. Two engineer/owner approved copies of the shop drawings shall be submitted to Fire Marshal. No fire alarm devices, conduit, boxes, wiring, etc., shall be installed until after the Fire Marshal approves the shop drawings.
4. The final complete as built drawings to be submitted to Fire Marshal.
3. In addition to the requirements listed in Section 13851, the Fire Marshal requires the following information sent to his office with the shop drawings submittals:

REQUIRED INSPECTIONS: Contact the Fire Marshal's Office to schedule each inspection.

Forward to this office a copy of the checked documentation after the applicable acceptance and approved.

☐ "Contractor Test Certificate complying with NFPA 70 & 72

☐ Declined: The following errors /omissions / deficiencies were noted during the review of the plans submitted for this project.

***Alarm System Plans Sheet Criteria:***

- ☐ Name of Owner & Occupant
- ☐ Location / Address
- ☐ Name / Address of Fire Alarm Contractor.
- ☐ List the codes on the 1<sup>st</sup> page of this review letter on the coversheet of the drawings NFPA 70 and 72.
- ☐ Codes and Standards adopted by the County and used for the design of the Alarm System and all devices and wiring within the system.
- ☐ Occupancy Classification on drawings.
- ☐ Location of partitions
- ☐ Location of firewalls
- ☐ A graphic representation of the scale used on all plans

***Details Required On Drawings***

- ☐ Where alarm system is extended or modified, enough of the existing system indicated on the plans to make all conditions clear
- ☐ Underwriters Laboratories, Inc. or other approved fire stopping on drawings if applicable.

- ☐ Identify fire separations on drawings
- ☐ Fire sealant system for penetrations in firewalls must be identified by the type of Floor Plan
- ☐ Location of alarm-initiating and notification appliances
- ☐ Audio and Candela power of each notification device
- ☐ Alarm control and trouble signaling equipment.
- ☐ Annunciation
- ☐ Power Connection
- ☐ Battery calculations
- ☐ Conduit type and sizes
- ☐ Voltage drop calculations
- ☐ Manufacturers, model numbers, and listing information for equipment, devices and materials.
- ☐ Details of ceiling height and construction
- ☐ The interface of fire safety control functions

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- 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.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Low Voltage System contractor shall furnish and install a fire alarm system with an addressable fire detection and alarm system, UL labeled, conforming with NEMA, standard building code, and NFPA 101 standards for Assembly class "B" Occupancy (greater than 300 occupancy) and educational occupancy. The fire alarm system shall be designed, furnished and installed subject to compliance with requirements:
  - 1. Wire and Cable:
    - a. Comtran Corporation.
    - b. Helix/HiTemp Cables, Inc.; a Draka USA Company.
    - c. Rockbestos-Suprenant Cable Corporation; a Marmon Group Company.
    - d. West Penn Wire/CDT; a division of Cable Design Technologies.

2. Audible and Visual Signals:
  - a. Amseco; a division of Kobishi America, Inc.
  - b. Commercial Products Group.
  - c. Gentex Corporation.
  - d. System Sensor; a GE-Honeywell Company.

## 2.2 FACP

### A. General Description:

1. Modular, power-limited design with electronic modules, UL 864 listed.
2. Addressable initiation devices that communicate device identity and status.
  - a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at the FACP.
  - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
3. Addressable control circuits for operation of mechanical equipment.

### B. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

**Fill out the systems annunciator display listing the locations of all devices by the owners room numbers. 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 systems zones. Refer to the electrical drawing detail sheets for additional information.**

1. Annunciator and Display: Liquid-crystal type, two line(s) of 40 characters, minimum.

### C. Circuits:

1. Signaling Line Circuits: NFPA 72, Class A, Style 6.
  - a. System Layout: Install no more than 50 addressable devices on each signaling line circuit.
2. Notification-Appliance Circuits: NFPA 72, Class A, Style Z.
3. Actuation of alarm notification appliances, emergency voice communications, annunciation, smoke control, elevator recall, shall occur within 10 seconds after the activation of an initiating device.

### D. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm verification" signal at the FACP.
2. Activate a listed and approved "alarm verification" sequence at the FACP and the detector.
3. Sound general alarm if the alarm is verified.
4. Cancel FACP indication and system reset if the alarm is not verified.

### E. Notification-Appliance Circuit: Operation shall sound in a 60 beats per minute, march-time pattern.

- F. Power Supply for Supervision Equipment: Supply for audible and visual equipment for supervision of the ac power shall be from a dedicated dc power supply, and power for the dc component shall be from the ac supply.
- G. Alarm Silencing, Trouble, and Supervisory Alarm Reset: Manual reset at the FACP, and remote annunciators, after initiating devices are restored to normal.
  - 1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
  - 2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
  - 3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.
- H. Walk Test: A test mode to allow one person to test alarm and supervisory features of initiating devices. Enabling of this mode shall require the entry of a password. The FACP and annunciators shall display a test indication while the test is underway. If testing ceases while in walk-test mode, after a preset delay, the system shall automatically return to normal.
- I. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, trouble, and supervisory signals to a remote alarm station through a digital alarm communicator transmitter and telephone lines.
- J. Voice/Alarm Signaling Service: A central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided as a special module that is part of the FACP. The Voice/Alarm Signaling shall be installed in the gymnasium.
  - 1. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different zones, or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall be UL 1711 listed.
    - a. Allow the application of and evacuation signal to indicated number of zones and, at the same time, allow voice paging to the other zones selectively or in any combination.
    - b. Programmable tone and message sequence selection.
    - c. Standard digitally recorded messages for "Evacuation" and "All Clear."
    - d. Generate tones to be sequenced with audio messages of the type recommended by NFPA 72 and that are compatible with tone patterns of the notification-appliance circuits of the FACP.
  - 2. Notification-Appliance Circuits: NFPA 72, Class A.
  - 3. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
  - 4. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.
- K. Service Modem: Ports shall be RS-232 for system printer and for connection to a dial-in terminal unit.
  - 1. The dial-in port shall allow remote access to the FACP for programming changes and system diagnostic routines. Access by a remote terminal shall be by encrypted password algorithm.
- L. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signal, supervisory and digital alarm communicator transmitter shall be powered by the 24-V dc source. Where the contractor installs subpanels for power to the system devices, he shall run ½" & #10 conductors to the nearest 120 volt emergency panel and connect to a spare 20a/1p breaker. Locate all subpanels on the shop drawing floor plans. ALL PANELS



SHALL BE LOCATED IN THE ELECTRICAL ROOMS. ALL BREAKERS THAT SERVE THE MAIN FIRE ALARM PANEL AND BOOSTER PANELS SHALL BE PAINTED RED IN COLOR AND SHALL BE LOCKED OUT IN THE "ON" POSITION.

1. The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
  2. Power supply shall have a dedicated fused safety switch for this connection at the service entrance equipment. Paint the switch box red and identify it with "FIRE ALARM SYSTEM POWER."
- M. Secondary Power: 24-V dc supply system with batteries and automatic battery charger and an automatic transfer switch.
1. Batteries: Sealed lead calcium.
  2. Battery and Charger Capacity: Comply with NFPA 72.
- N. Surge Protection:
1. Install surge protection on normal ac power for the FACP and its accessories. Comply with Division 16 Section "Transient Voltage Suppression" for auxiliary panel suppressors.
  2. Install surge protectors recommended by FACP manufacturer. Install on all system wiring external to the building housing the FACP.
- O. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.
- P. Interconnect fire alarm system to the new tone generator system in the intercom system. Such that upon activation of any initiation device, a preset audible alarm will be sent on all intercom speakers. In addition, the contractor shall furnish and install all control between the two systems such that upon silencing the alarm on the fire alarm panel it automatically silences the tone generator on the intercom system.

## 2.3 MANUAL FIRE ALARM BOXES

- A. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box.
1. Single-action mechanism, pull-lever type. With integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.
  2. Station Reset: Key- or wrench-operated switch.
  3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.

## 2.4 SYSTEM SMOKE DETECTORS

- A. General Description:
1. UL 268 listed, operating at 24-V dc, nominal.
  2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

3. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring.
4. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
5. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status.

B. Photoelectric Smoke Detectors:

1. Sensor: LED or infrared light source with matching silicon-cell receiver.
2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.

C. Duct Smoke Detectors:

1. Photoelectric Smoke Detectors:

- a. Sensor: LED or infrared light source with matching silicon-cell receiver.
- b. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.

2. UL 268A listed, operating at 24-V dc, nominal.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
  - a. Weatherproof Duct Housing Enclosure: UL listed for use with the supplied detector. The enclosure shall comply with NEMA 250 requirements for Type 4X.
5. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status. Provide remote status and alarm indicator and test station in the wall at 18" below the finished ceiling under the unit. Furnish and install red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, device indicating the name of the HVAC equipment that is served by this detector light
7. Each sensor shall have multiple levels of detection sensitivity.
8. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
9. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.
10. Refer to the mechanical equipment schedules for the exact quantity and locations of all duct mounted smoke detectors and dampers.

2.5 HEAT DETECTORS

A. General: UL 521 listed.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or rate-of-rise of temperature that exceeds 15 deg F per minute, unless otherwise indicated.

1. Mounting: Plug-in base, interchangeable with smoke-detector bases.

2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

## 2.6 NOTIFICATION APPLIANCES

- A. Description: Equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly. **All alarms shall sound the visual and audible alarms at the same time throughout the building.**

- B. Visible Alarm Devices: Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.

1. Rated Light Output: 75 candela.
2. Strobe Leads: Factory connected to screw terminals.

- C. Notification Appliance – High Fidelity Speaker

1. High Fidelity Speakers shall have a 4" Mylar/paper cone. The rear of the speakers shall be completely sealed protecting the cone during and after installation. In and out screw terminals shall be provided for wiring. Speakers shall provide 1/4w, 1/2w, 1w, and 2w power taps for use with 70V systems. The actual speaker wattage & strobe candela setting shall be view from the device window to verify the wattage setting, without removing the device. To make any changes to the speaker wattage will only require the removal of the cover plate.
2. High Fidelity Speaker listed frequency response of 400 to 4,000 Hz and listed sound output of 90.5 dBA at 10 feet, as measured in reverberation room per UL-1480. Speaker shall be listed in compliance to produce 520Hz low frequency tone signal.
3. The following selectable sound level output:
  - a. 1/4watt – 81.5 dBA
  - b. ½ watt – 84.1 dBA
  - c. 1 watt – 87.3 dBA
  - d. 2 watt – 90.5 dBA

## 2.7 SPRINKLER SYSTEM REMOTE INDICATORS

- A. Remote status and alarm indicator and test stations, with LED indicating lights. Light is connected to flash when the associated device is in an alarm or trouble mode. Lamp is flush mounted in a single-gang wall plate. A red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, device initiating the signal and room where the smoke detector or valve is located. For water-flow switches, the identification plate also designates protected spaces downstream from the water-flow switch.

## 2.8 MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching door plate.
1. Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.

2. Wall-Mounted Units: Flush mounted, unless otherwise indicated.
3. Rating: 24-V ac or dc.

B. Material and Finish: Match door hardware.

## 2.9 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to the elevator controller to initiate elevator recall

## 2.10 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Listed and labeled according to UL 632.
- B. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising 2 lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.
- C. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.
- D. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

## 2.11 GUARDS FOR PHYSICAL PROTECTION

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
  1. Factory fabricated and furnished by manufacturer of the device.
  2. Finish: Paint of color to match the protected device.

## 2.12 WIRE AND CABLE

- A. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.
- B. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG.
  1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70 Article 760, Classification CI, for power-limited fire alarm signal service. UL listed as Type FPL, and complying with requirements in UL 1424 and in UL 2196 for a 2-hour rating.
- C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

1. Low-Voltage Circuits: No. 16 AWG, minimum.
  2. Line-Voltage Circuits: No. 12 AWG, minimum.
- D. All electrical power, equipment, and systems (Generator, Fire Alarm, Intercom, Gym Sound System, etc.,). Electrical equipment and distribution shall be completely installed and operational 45 days prior to Substantial Completion. Electrical power and system completion shall also include completion of all certifications, tests and closeout documentation.

## 2.13 CARBON MONOXIDE DETECTORS

### A. Intelligent Carbon Monoxide Detector

1. Provide Intelligent CO Sensor is an intelligent device that uses a CO sensor to detect carbon monoxide from any source of combustion and analyzes the sensor data to determine when to initiate a life safety CO alarm. Carbon monoxide electrolytic sensing module shall provide toxic gas sensing to UL2034 and UL2075 standards.
2. The detector signals to the control panel when the CO sensor reaches its end of life. The CO element shall be field replaceable.
3. The CO Detector shall activate upon the following conditions:
  - a. 70 PPM for 60 – 240 minutes
  - b. 150 PPM 10- 50 minutes
  - c. 400 PPM 4 – 15 minutes
4. The CO activation shall be programmable type as follows: Alarm, Supervisory Latching, Supervisory Non-Latching, Monitor Latching, or Monitory Non-Latching.

## PART 3 - EXECUTION

### 3.1 EQUIPMENT INSTALLATION

- A. HVAC: Locate detectors not closer than 6 feet from air-supply diffuser or return-air opening.
- B. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of the duct.
- C. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

Furnish and install labels on each fire alarm device that indicates the device number and loop number. All labels shall be furnished and installed prior to testing. Labels shall be self-adhesive attached to the device.

Furnish and install labels on each fire alarm device box that indicates the device number and loop number.

- D. Audible Alarm-Indicating Devices: Refer to section 16050 for mounting heights of equipment. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- E. Visible Alarm-Indicating Devices: Refer to section 16050 for mounting heights of equipment.
- F. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- G. FACP: Surface mount with tops of cabinets not more than 72 inches above the finished floor.

- H. Annunciator: Install with top of panel not more than 48 inches above the finished floor.

### 3.2 WIRING INSTALLATION

- A. Install wiring according to the following:
1. NECA 1.
  2. TIA/EIA 568-A.
- B. Wiring Method: Install wiring in metal raceway according to Division 16 Section "Raceways and Boxes."
1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
- C. Wiring Method:
1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
  2. Fire-Rated Cables: Use of 2-hour fire-rated fire alarm cables, NFPA 70 Types MI and CI, **is not permitted**.
  3. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or raceway as signaling line circuits.
- D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made. All locations shall be indicated on the point to point wire diagrams.
- F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- G. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

### 3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to Division 16 Section "Electrical Identification."
- B. Install instructions frame in a location visible from the FACP.
- C. Paint power-supply disconnect switch red and label "FIRE ALARM."

### 3.4 GROUNDING

- A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

### 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.
- B. The manufacturer shall aid the owner's representative and help test and trouble shoot the system prior to substantial completion. Perform the following field tests and inspections and prepare test reports:
  - 1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
  - 2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at Level III.
  - 3. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.
  - 4. Testing: Follow procedure and record results complying with requirements in NFPA 72.
    - a. Detectors that are outside their marked sensitivity range shall be replaced.
  - 5. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.

**A point by point checkout with the Owner's representative shall be scheduled and performed prior to the 45 test period. Manufacturer shall certify system in written format prior to the requested point to point system check out.**

- 6. Furnish and install a complete half size laminated set of as built fire alarm point to point wiring diagrams indicating all device locations, device zone numbers and names, panel locations, power sub panel locations, circuiting routing, slice locations, and be capable of showing installed conditions accurately. These drawings shall be furnished to the owner prior to substantial completion of the project. Furnish and install an additional copy to be stored in a tube mounted at the main fire alarm control panel. Coordinate the exact location with building official.

### 3.6 ADJUSTING

- A. Annual Test and Inspection: One year after date of Final Completion, test the fire alarm system complying with the testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for monthly, quarterly, semiannual, and annual periods. Use forms developed for initial tests and inspections.

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices. Refer to Division 1 Section Closeout Procedures."

A New Classroom Addition for:  
Davis Elementary School

SECTION 13851  
Fire Alarm

END OF SECTION 13851



## SECTION 13915 - FIRE SUPPRESSION PIPING

### 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 fire-suppression piping inside the building:
  - 1. Wet-pipe sprinkler systems.
- B. Related Sections include the following:
  - 1. Division 2 Section "Site Water Distribution & Fire Protection" for piping outside the building.
  - 2. Division 10 Section "Fire-Protection Specialties" for cabinets and fire extinguishers.
  - 3. Division 13 Section "Fire Alarm" for alarm devices not specified in this Section.
  - 4. Section 15050 "Basic Mechanical Materials and Methods" for common products, installation accessories, and submittal requirements.
  - 5. Section 15075 "Mechanical Identification" for piping identification.

#### 1.3 DEFINITIONS

- A. Underground Service-Entrance Piping: Underground service piping below the building.

#### 1.4 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.
- B. BASIS OF DESIGN
  - 1. All piping shall be hydraulically sized based on flow test data as obtained at the project site, less a 10% safety factor applied against residual pressure only. Overhead systems shall be calculated to provide minimum densities as specified herein. Provide for outside hose stream demands in accordance with NFPA 13.
  - 2. It is the Contractor's responsibility to visit the site and perform a certified flow test, consult with the local authority having jurisdiction, or otherwise obtain positive confirmation of the available water supply prior to the commencement of hydraulic calculations and design. Contractor shall submit written documentation of any flow test data obtained through this procedure. Fire flow tests performed at the site shall

- be witnessed by an independent third party knowledgeable of these matters, and attesting thereto in writing, by a representative of the Owners' fire insurance underwriter or by the local authority having jurisdiction.
3. This Contractor shall be responsible for the design, fabrication, and installation of a finished sprinkler system which will deliver the specified design density over the specified area of application, with suitable allowances for inside and outside hose streams, pipe, valve and fitting losses, changes in elevation, sprinkler flow coefficients, excess flows and for hydraulic balancing, and any other necessary adjustments peculiar to this particular system to achieve the finished design to comply with these requirements.
  4. Otherwise, as specified in section 15050 "Basic Mechanical Materials and Methods", submittal of a bid shall indicate contractor has examined site and drawings and has included all required allowances in his bid. No allowance shall be made for any error resulting from contractor's failure to visit job site and review drawings. Bid shall include costs for all required drawings and changes as outlined above.
  5. Minimum design densities for this project shall be .10 G.P.M./ square foot over the hydraulically most remote 1500 square feet of floor area (Remote area may be reduced per the strict requirements of NFPA 13, paragraph 11.2.3.2.3), with 100 G.P.M. reserved for outside hose streams, (in accordance with the requirements of NFPA 13 for Light Hazard Occupancies).
  6. Mechanical Rooms, Storage Rooms, and Mechanical Platform areas shall be designed with a minimum density of .15GPM/square foot over the hydraulically most remote 1500 square feet of floor area with 250 GPM reserved for outside hose streams, (in accordance with the requirements of NFPA 13 for Ordinary Hazard Group I occupancies).

#### 1.6 SUBMITTALS

- A. Product Data: For the following:
  1. Pipe hangers and supports, including seismic restraints where required.
  2. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
  3. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
  4. Alarm devices, including electrical data.
- B. Shop Drawings: Pipe sizes and routing, building elevations and hydraulic calculations.
- C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations. Sprinkler layout drawings shall be submitted to the structural Engineer for review of all supporting system details and hanger locations prior to submittal to the Fire Marshal.
- D. Shop drawings for the fire suppression systems shall be submitted to the Engineer of record at the same time they are submitted to the Fire Marshal for approval.
- E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
- F. Field quality-control test reports.

- G. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.
- H. Closeout Documentation: To include, but not limited to as-built piping drawings with seismic restraint systems noted and detailed as applicable.

#### 1.7 QUALITY ASSURANCE

- A. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:
  - 1. NFPA 13, "Installation of Sprinkler Systems."
  - 2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."
  - 3. NFPA 230, "Fire Protection of Storage."

#### 1.8 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies. Shop drawing layout drawings shall indicate all devices to be installed in the ceiling on the plans.
- B. Sprinkler heads and piping installed at intermediate levels in stairwells shall be installed tight to underside of structure high as possible.

#### 1.9 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. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project. Cabinets shall be located adjacent to the sprinkler riser.

### 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. All products and components installed in the system shall be listed by Underwriters Laboratories (U.L.) and approved by Factory Mutual Engineering (FM).

#### 2.2 STEEL PIPE AND FITTINGS

- A. Domestic Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed threaded ends.

1. Cast-Iron Threaded Flanges: ASME B16.1.
  2. Malleable-Iron Threaded Fittings: ASME B16.3.
  3. Gray-Iron Threaded Fittings: ASME B16.4.
  4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe hot-dip galvanized where indicated. Include ends matching joining method.
  5. Steel Threaded Couplings: ASTM A 865 hot-dip galvanized-steel pipe where indicated.
  6. Manufacturers:
    - a. Smith-Cooper
    - b. Stockham
    - c. Grinnell/Anvil International
- B. Grooved End - Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and greater than Schedule 10, and with factory- or field-formed grooved ends.
1. Approved Manufacturers:
    - a. Bullmoose Tube Company
    - b. Wheatland Tube Company
    - c. Allied Pipe
    - d. Northwest Pipe
    - e. Weld-Tube
    - f. Youngstown Tube Company
- C. Grooved End - Couplings:
1. Approved Manufacturers:
    - a. Victaulic
    - b. Gruv-Lock
    - c. Frink

## 2.3 LISTED FIRE-PROTECTION VALVES

- A. Valves shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Valves shall have 250-psig minimum 300-psig pressure rating if valves are components of high-pressure piping system.
- B. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.
1. Manufacturers:
    - a. Tyco
    - b. Central Sprinkler Corp.
    - c. Anvil International.
    - d. Viking Sprinkler Co.
    - e. Kennedy.
    - f. NIBCO.
    - g. Reliable Automatic Sprinkler Co., Inc.
    - h. Star Sprinkler Inc.
    - i. Stockham.
    - j. Victaulic Co. of America.
- C. Gate Valves: UL 262, OS&Y type.
1. NPS 2 and Smaller: Bronze body with threaded ends.
    - a. Manufacturers:
      - 1) Tyco
      - 2) NIBCO.

- 3) United Brass Works, Inc.
- 4) Reliable Automatic Sprinkler Co., Inc.
- 5) Stockham.
- 6) Viking Sprinkler Co.

## 2.4 SPRINKLERS

- A. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure. All sprinkler heads shall be the products of one manufacturer.
- B. Manufacturers:
  1. Central Sprinkler Corp.
  2. Tyco
  3. Reliable Automatic Sprinkler Co., Inc.
  4. Victaulic Co. of America.
  5. Viking Corp.
- C. Automatic Sprinklers: With heat-responsive element 155°-165°F range, complying with the following:
  1. UL 199, for nonresidential applications.
- D. Sprinkler Types
  1. Sprinkler heads for installation in areas with acoustical tile ceilings with piping concealed above ceiling shall be standard 1/2" orifice, semi-recessed chrome plated pendent sprinkler heads with chrome escutcheons. Sprinklers shall be quick response type for all light hazard occupancies.
  2. Sprinkler heads for installation in gyp board ceilings shall be concealed pendent type, standard 1/2" orifice with white closure plate to fit flush with face of ceiling.
  3. Exposed sprinkler heads on exposed piping shall be standard 1/2" orifice, brass upright, with bronze finish.
  4. Sidewall sprinkler heads, where required, shall be horizontal sidewall heads, 1/2" orifice, with chrome plated finish.
  5. No wet pipe sprinkler piping shall be routed thru or installed above non heated spaces above ceilings or soffits.
- E. Sprinkler Head Specialties and Options:
  1. Install sprinkler guards on all sprinklers located lower than 7'-0" above the floor.
  2. Fire sprinklers installed in locations subject to direct sunlight or elevated temperatures shall have minimum 200-212 degree Fahrenheit temperature rating.
  3. Exposed horizontal sprinkler piping in lowest landing of stairwells shall be installed tight to structure. Piping shall be routed parallel to and above bottom steel framing so that piping is not accessible.

## 2.5 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Water-Motor-Operated Alarm: UL 753, mechanical-operation type with pelton-wheel operator with shaft length, bearings, and sleeve to suit wall construction and 10-inch diameter, cast-aluminum alarm gong with red-enamel factory finish. Include NPS 3/4 inlet and NPS 1 drain connections.
  1. Manufacturers:
    - a. Central Sprinkler Corp.

- b. Tyco
  - c. Victaulic Co. of America
  - d. Reliable Automatic Sprinkler Co., Inc.
  - e. Star Sprinkler Inc.
  - f. Viking Corp.
- C. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
  - 1. Manufacturers:
    - a. Potter Electric Signal Company.
    - b. System Sensor.
    - c. TYCO Fire Protection Products
- D. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
  - 1. Manufacturers:
    - a. Potter Electric Signal Company.
    - b. System Sensor.
    - c. Kennedy Valve; division of McWane Industries.

## 2.6 PRESSURE GAGES

- A. Manufacturers:
  - 1. AGF Manufacturing Co.
  - 2. AMETEK, Inc.; U.S. Gauge.
  - 3. Brecco Corporation.
  - 4. Dresser Equipment Group; Instrument Div.
- B. Description: UL 393, 3-1/2- to 4-1/2-inch- diameter, dial pressure gage with range of 0 to 250 psig minimum
  - 1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.
  - 2. Air System Piping: Include caption "AIR" or "AIR/WATER" on dial face.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction, framing for hose-station cabinets, hose valve cabinets and other conditions where hose connections and stations are to be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PIPING APPLICATIONS, GENERAL

- A. Shop weld pipe joints where welded piping is indicated.

- B. Do not use welded joints for galvanized-steel pipe.
- C. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated. The velocity in the overhead piping shall not exceed 20 ft. per second.

### 3.3 SPRINKLER SYSTEM PIPING APPLICATIONS

- A. Standard-Pressure, Wet-Pipe Sprinkler System, 175-psig Maximum Working Pressure:
  - 1. NPS 1-1/2 and Smaller: Threaded-end, black standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
  - 2. NPS 2: Threaded-end, black standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.

### 3.4 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13.
    - a. Shutoff Duty: Use ball, butterfly, or gate valves.

### 3.5 JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.
  - 1. Ductile-Iron Pipe: Radius-cut-groove ends of piping. Use grooved-end fittings and grooved-end-pipe couplings.

### 3.6 PIPING INSTALLATION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- B. The system shall be installed by an experienced firm duly licensed by the State of Georgia Fire Marshall's Office for the installation of fire sprinkler systems and which shall, upon request, submit the names of 3 installations of similar size giving satisfactory service.
- C. All welders and welding procedures shall be qualified according to the American Welding Society Standard AWS D10.9 Level AR-3 and written record of this qualification shall be submitted.
- D. No fire sprinkler piping shall be routed overhead within a 42" envelope of any electrical panel or switchboard, contiguous to the structure above. Coordinate sprinkler requirements within electrical spaces with the local Authority Having Jurisdiction. Provide and install spray deflection shields with drains wherever required to prevent spraying water directly on live electrical apparatus. Drains shall be sloped away to the closest point of indirect connection with the sanitary sewer system. Coordinate this requirement with the plumbing

contractor, in order to incorporate adequate drainage measures with the gravity sanitary sewer system.

- E. Locations of all test and drain piping shall be closely coordinated with the architect. Wherever possible, and subject to the local Authority Having Jurisdiction, route inspectors test and drain connections, and auxiliary drain systems concealed above ceilings, with proper identification signage for test and drain valves, above ceilings, with discharge piping (normally dry) concealed in exterior wall to terminate outside, above grade, with the required orifice simulating flow from a single sprinkler head. Where discharge piping is not installed in paved or concrete walks a splash block shall be installed at discharge location of test and drain.
- F. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Install alarm devices in piping systems.
- I. Hangers and Supports: Comply with NFPA 13 for hanger materials.
  - 1. Install sprinkler system piping according to NFPA 13.
  - 2. Hanger rod size for sprinkler mains 4" and larger shall be 1/2" minimum.
- J. Earthquake Protection: Install piping according to NFPA 13 to protect from earthquake damage.
- K. Install pressure gages on each sprinkler alarm valve assembly. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal and install where they will not be subject to freezing.
- L. Fill wet-pipe sprinkler system piping with water.
- M. All sprinkler piping shall be installed clean and free of rust. Rusted piping shall be cleaned, primed and painted by the Contractor before system will be accepted.
- N. Sprinkler piping installed above light fixtures shall have 6" minimum clearance between the top of the light fixture and the bottom of the pipe.

### 3.7 VALVE INSTALLATION

- A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection where shown on plans.

### 3.8 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels and tiles.



- B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

### 3.9 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and in Division 15 Section "Mechanical Identification".
- B. The Contractor shall install fire zone diagrams for each level of minimum scale of 1" = 20' (equivalent to contract drawings) showing all fire protection system mains, valves, inspectors' test and drain locations for each system and system zone limit lines. Diagrams shall be mounted on plywood board under clear Plexiglas cover in a frame and posted next to the sprinkler alarm valve assembly in the main mechanical room. Posting shall be completed prior to project Final Completion and shall reflect all as-built conditions.
  - 1. Each diagram shall include but not be limited to the following:
    - a. Project name
    - b. Color coded zones with same zone on different level the same color.
    - c. Legend showing sectors incorporated (referenced from Architectural plans), supply riser identifier and system area (sq. ft)
    - d. Riser valve location chart showing supply riser number, color code and room number (referenced from Architectural plans)
    - e. Routing of all outside underground fire mains with hydrants shown and pipe sizes.
    - f. Location of test-and-drain valve assembly for each zone.
  - 2. Each zone shall be labeled to include, but not limited to, the following:
    - a. Zone identifier (number or letter)
    - b. Sector(s) included in zone (referenced from Architectural plans).
    - c. Sprinkler shop drawing number(s) for that area.

### 3.10 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Leak Test: After installation, charge system for 24 hours minimum time period and test for leaks. Repair leaks and retest for 24 hours until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Energize circuits to electrical equipment and devices.
  - 4. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
  - 5. Coordinate with fire alarm tests. Operate as required.
- B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

### 3.11 CLEANING AND PROTECTION

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.
- C. Protect sprinklers from damage until Final Completion.

3.12 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire/sprinkler piping system. Refer to Division 1 Section "Closeout Procedures, Demonstration and Training."

END OF SECTION 13915

## **SECTION 15050 - BASIC MECHANICAL MATERIALS & 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. Piping materials and installation instructions common to most piping systems.
  - 2. Transition fittings.
  - 3. Dielectric fittings.
  - 4. Sleeves.
  - 5. Escutcheons.
  - 6. Grout.
  - 7. Equipment installation requirements common to equipment sections.
  - 8. Painting and finishing.
  - 9. Concrete bases.
  - 10. Supports and anchorages.
  - 11. Access panels

#### **1.3 DEFINITIONS**

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and mechanical platform areas.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
  - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
  - 2. CPVC: Chlorinated polyvinyl chloride plastic.
  - 3. PE: Polyethylene plastic.

4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

#### 1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

#### 1.6 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."
- D. Coordinate locations of floor drains and floor cleanouts with HVAC Equipment pads and units in all mechanical equipment rooms and closets. Coordination layout drawings shall be prepared and coordinated by all trades.
- E. No mechanical, plumbing or fire protection equipment, ductwork or piping shall be located overhead within 42" of electrical switchboards or panelboards.

- F. No water piping (HVAC, domestic, storm, sanitary, or sprinkler) shall be located above electrical switchboards or panelboards. If the governing authority requires fire sprinklers in the electrical rooms, spray shields shall be fabricated and installed to protect the live panels or switchboards from spray from sprinkler discharge.

## 1.7 CODES AND REGULATIONS

- A. All materials and workmanship shall comply with the latest editions of the following codes and standards, as applicable:

Manufacturer's Standardization Society (MSS) Standard Practice (SP) 58: Pipe Hangers and Supports - Materials, Design and Manufacture

MSS SP-69: Pipe Hangers and Supports - Selection and Application

MSS SP-69: Pipe Hangers and Supports - Fabrication and Installation Practices

NFPA 90A: Installation of Air Conditioning and Ventilating Systems

NFPA 90B: Installation of Warm Air Heating and Air Conditioning Systems

NFPA 96: Installation of Equipment for the Removal of Smoke and Grease Laden Vapors from Commercial Cooking Equipment

NFPA 101: Safety to Life from Fire in Buildings and Structures

NFPA 211: Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances

NFPA 231: General Storage

National Electrical Code, 2017 Edition, with Georgia Amendments

International Mechanical Code, 2012 Edition, with Georgia Amendments

International Energy Conservation Code, 2009 Edition, with Georgia Amendments

International Building Code, 2012 Edition, with Georgia Amendments

International Plumbing Code, 2012 Edition, with Georgia Amendments

International Fuel Gas Code, 2012 Edition, with Georgia Amendments

All local prevailing County codes and Ordinances

- B. All workmanship and materials shall comply with all ordinances and regulations of all local authorities having jurisdiction.
- C. Contractor shall obtain all permits and licenses, and pay all fees, as required for execution of the contract. Arrange for necessary inspections required by City, County, State and other authorities having jurisdiction, and deliver certificates of approval to the Owner. In compliance

with the Georgia State Boiler Code, it is the responsibility of the Contractor (at his expense) to have each boiler and/or applicable pressure vessel inspected by a State of Georgia certified inspector upon installation of this equipment.

- D. This inspection report shall be submitted to the Georgia Department of Labor, Safety Engineering Section, 501 Pullman Street, Room 210, Atlanta, Georgia 30312, Attention Chief Safety Engineer.
- E. Upon the Georgia Department of Labor review of the inspection report and their inspection, they will place a tag indicating the State Serial Number on the inspected piece of equipment and issue a certificate of boiler or pressure vessel inspection. The original certificate issued is to be posted in the main Mechanical Room, with a copy sent to Fulton County Public Schools and one copy is to be included in the closeout documents.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### 2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 15 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

### 2.3 JOINING MATERIALS

- A. Refer to individual Division 15 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-soluble flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining Plastic Piping:
  - 1. ABS Piping: ASTM D 2235.
  - 2. CPVC Piping: ASTM F 493.
  - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
  - 4. PVC to ABS Piping Transition: ASTM D 3138.

## 2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
  - 1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Dresser Industries, Inc.; DMD Div.
    - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
    - d. JCM Industries.
    - e. Smith-Blair, Inc.
    - f. Viking Johnson.
  - 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
  - 3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
  - 4. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
  - 1. Manufacturers:
    - a. Eslon Thermoplastics.
    - b. Spears Mfg. Co.
    - c. Georg Fischer Piping Systems - Doublesafe
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
  - 1. Manufacturers:
    - a. Thompson Plastics, Inc.
    - b. Spears Mfg. Co.
    - c. Georg Fischer Piping Systems - Doublesafe
- D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
  - 1. Manufacturers:
    - a. NIBCO INC.
    - b. NIBCO, Inc.; Chemtrol Div.

- c. Spears Mfg. Co.
- d. Georg Fischer Piping Systems - Doublesafe

## 2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
  - 1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Eclipse, Inc.
    - d. Epco Sales, Inc.
    - e. Hart Industries, International, Inc.
    - f. Watts Industries, Inc.; Water Products Div.
    - g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
  - 1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Epco Sales, Inc.
    - d. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
  - 1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Central Plastics Company.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Separate companion flanges and steel bolts and nuts shall have 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
  - 1. Manufacturers:
    - a. Calpico, Inc.
    - b. Lochinvar Corp.
    - c. Watts
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
  - 1. Manufacturers:



- a. Perfection Corp.
- b. Precision Plumbing Products, Inc.
- c. Sioux Chief Manufacturing Co., Inc.
- d. Victaulic Co. of America.

## 2.6 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Sleeves shall be installed on all pipe installed thru walls and floors.

## 2.7 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated.
- D. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- E. One-Piece, Floor-Plate Type: Cast-iron floor plate.

## 2.8 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## 2.9 MACHINERY GUARDS

- A. Provide guards for moving equipment such as fan belt drives and motor drive couplings.

- B. Use OSHA approved belt guards and coupling guards. Provide ½ inch hole in guard at center of shaft of driven equipment where belt type drives are used.

## 2.10 BOLTED CONNECTIONS

- A. Accurately punch, drill or ream bolt holes and remove burrs. Use washers, lock washers, and self-locking nuts as specified on Drawings, and as otherwise required. Tighten all bolts and nuts. Use screw threads conforming to National or Unified forms in accordance with Bureau of Standards Handbook H28. Do not use sheet metal screws. Use machine bolts where access or nuts would not be possible, and where unbolting may be required, in which case utilize sufficient thickness of metal to assure that 2 complete bolt threads are engaged. Secure machine bolts in place by proper lock washers.

## 2.11 MATERIALS FOR TESTING

- A. All detergents, solvents and other cleaning shall be compatible with the materials of fabrication of the systems, in which they are used. They shall not adversely affect the materials or mechanisms in the systems and they shall be acceptable to equipment manufacturers. All detergents, solvents and other cleaning agents shall also be compatible with the process streams to be handled by the system in which they are used.
- B. Blinds, gaskets, bolts, etc., used in isolating segments of systems shall conform to the specification for adjacent materials.
- C. Contractor shall furnish all labor, tools and equipment required for pressure testing piping systems.

## 2.12 ACCESS DOORS & PANELS

- A. Furnish an access door and panels for each pipe and duct chase for each floor, fire dampers, etc. Size as required for access, 16" X 16" minimum.
- B. Also, provide access doors in all non-removable ceilings and in partitions and walls where necessary to maintain access to fire dampers, manual dampers, valves, shock arrestors, and other mechanical devices requiring access.
- C. Any access door installed in fire rated surface or assembly shall carry a U.L. Listing and an approved fire rating for that construction type.
- D. Provide access doors/panels as required to test and reset automatic fire dampers.
- E. Provide all access doors to the General Contractor for the timely inclusion in the building construction.
- F. Refer to architectural section "08311 – ACCESS DOORS AND FRAMES" for product's construction and installation requirements.

## PART 3 - EXECUTION

### 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
  - 1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
- M. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs inclusive of cored holes.

- N. Install continuous polyethylene sleeves around all trap primer lines below slab on grade pours from trap primer connection at drain to above finished floor elevation in walls and/or chases.
- O. Install schedule 40 steel sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floors.
  - 1. Cut sleeves to length for mounting to extend 1" beyond face of finished surface on both sides.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas in overhead slabs 2 inches above finished floor level.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Steel Pipe Sleeves: For pipes smaller than NPS 8.
    - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
  - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint.
- P. Refer to Division 7 Section "Joint Sealants" for non-rated assemblies and "Through Penetration Firestop Systems" for rated assemblies materials and installation.
- Q. Aboveground, Exterior-Wall Pipe 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.
  - 1. Install schedule 40 steel pipe for sleeves smaller than 6 inches in diameter.
  - 2. Install schedule 40 steel "wall pipes" for sleeves 6 inches and larger in diameter.
  - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials and installation requirements.
- S. Verify final equipment locations for roughing-in.
- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- U. **All wall penetrations shall be cored, drilled or cut.**

### 3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-soluble flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
  - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
  - 4. PVC Nonpressure Piping: Join according to ASTM D 2855.
  - 5. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

### 3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### 3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.
- E. All equipment shall be installed in strict conformance with manufacturer's recommendations, as specified herein and as shown. All work provided under this Division shall be installed under the direct supervision of contractors licensed by the State of Georgia.
- F. Plumbing work shall be under the direct supervision of a licensed Master Plumber, Class II.
- G. Heating, Ventilating, and Air-Conditioning work shall be under the direct supervision of a licensed Conditioned Air Contractor, Class II.
- H. The supervising license holders shall be identified, and a copy of their current valid license shall be provided as part of the initial submittal package.
- I. License holders shall accompany engineer on all required job site visits, and shall review and approve in writing, all shop drawings and submittals prior to forwarding to engineer for review.
- J. Where piping or equipment is exposed to view, special attention shall be given to pipe routing and installation, and the finished installation shall be neat and workmanlike, straight and parallel or perpendicular to the building construction. Piping exposed to view shall be primed and painted as directed by the Architect.
- K. All welders shall be qualified by an independent testing agency and certified in accordance with the requirements of ASME Section IX of the Boiler and Pressure Vessel Code. Contractor shall furnish certification of welder's qualifications with shop drawings.
- L. Maintain a minimum of 10' horizontal or 3' vertical clearance between outside air intakes and exhaust outlets. Exhaust outlets shall be located higher than intakes.
- M. Maintain 10' clearance from the edge of the roof for all roof mounted equipment.

### 3.5 ELECTRICAL WORK

- A. All electrical equipment provided under this Division shall comply with the electrical system characteristics present on the site and specified in Division 16.
- B. Motor controls, system controls, starters, pilot lights, push buttons, step-down transformers etc., shall be furnished complete as part of a motor apparatus which it operates. All components

shall be in conformance with the requirements of the National Electrical Code (2014 Edition) and Division 16.

- C. All power wiring and final connections to the system shall be provided under Division 16.
- D. Control wiring shall be provided under Division 15.

### 3.6 PRODUCT HANDLING, DELIVERY AND STORAGE

- A. Receive and handle all materials with care so as not to cause damage. Use padded or strap slings, etc., as appropriate for materials being handled. Lift equipment by lift points provided or recommended by manufacturer.
- B. Use proper tools, equipment and procedures to handle and lay pipe. Do not damage pipe coating, wrapping or linings. Repair or replace damaged pipe coatings, wrappings, or linings in accordance with manufacturer's instructions or as required to restore original protection.
- C. Inspect all materials, upon receipt, for defects and for compliance with Specifications.
- D. Properly store all equipment, pipe, piping materials, etc., so as to prevent deterioration while in storage. Store all materials off ground or off floor. Store inside and cover all materials subject to deterioration from weather.
- E. Store loose materials such as fittings, gaskets, bolts, nuts, small valves, traps, and specialties in adequate number of bins to properly separate. Protect ends of large fittings, valves and pipe from weather and abuse. Properly grease all machined surfaces.

### 3.7 PAINTING

- A. Factory painted equipment that has been scratched or marred shall be repainted to match original factory color.
- B. Field painting of all uninsulated black ferrous metal items exposed to sight such as equipment hangers, piping, frames and supports not provided with factory prime coat, shall be cleaned and painted with one coat of rust inhibiting primer. In addition, such items in finished spaces shall also be painted with two coats of finish paint in a color to match adjacent surfaces or as otherwise selected by the Architect, under Division 9 of the specifications. Ferrous metal items exposed to weather conditions shall be painted as specified under Division 9.
- C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### 3.8 CLEANING AND ADJUSTING

- A. The exterior surfaces of all mechanical equipment, fixtures, fittings, piping, ducts, etc., shall be cleaned of all grease, oil, paint and other construction debris.
- B. Start-up and adjustment of all HVAC equipment and water heaters shall be performed by certified factory representatives of the respective equipment manufacturer.

- C. Equipment controls and other accessories shall be adjusted to provide optimal and efficient operation.

### 3.9 TESTING

- A. Concealed or insulated piping and ductwork shall be tested in place before concealing, insulating or covering.
- B. Equipment, materials and instruments required for tests shall be furnished without incurring additions to the Contract.
- C. Refer to the individual specifications sections (for piping, ductwork or equipment) for specific testing requirements regarding that item.
- D. Provide factory start up on all major pieces of equipment, with letter of certification stating proper installation is present for the following components:

- Roof mounted A/C units
- Ductless Split Units
- Wall Hung Package A/C Units
- Fan-Coil Units
- Controls System
- Energy Management System
- Energy Recovery Units
- Pumps
- Fans
- Bi-Polar Ionization Units

### 3.10 SHOP DRAWINGS

- A. Submit a minimum of three hard copy sets of shop drawings along with an electronic formatted submittal for approval prior to commencing work. Hard copy shop drawings shall be bound in a three ring binder and shall include an index page with each item listed and referenced to sections with tabs. Tabs shall be cross referenced to index page. All shop drawings shall be prepared and submitted as a single package. **NO SHOP DRAWINGS WILL BE CHECKED UNTIL ALL HAVE BEEN SUBMITTED.** (HVAC controls submittals and any items with exceptionally long lead times that may affect the project completion date, as determined by the Engineer may be submitted separately). **Electronic shop drawings shall be a single PDF file and formatted as required for hard copy submittals. Each section shall be a bookmarked (tabbed) link named to describe the section. (ELECTRONIC SHOP DRAWINGS NOT PROPERLY FORMATTED WILL BE RETURNED UNCHECKED.)**
- B. The following format shall be followed:
  - 1. The submittal cover sheet shall include-
    - Project Name
    - Type of Shop Drawing including trade (HVAC, Plumbing, Fire Protection)
    - Mechanical Contractor's Company Name
    - Date of Submittal



2. The first sheet inside the submittal shall include all items on the cover sheet plus the following-  
Owner  
Architect  
Engineer  
Mechanical Contractor's Project Manager's Name
3. The supervising license holder(s) shall be identified, and a copy of their current valid license shall be included.
4. The second sheet shall include the following typed statement, signed and dated by the mechanical contractor's project manager-

"The enclosed submittal (shop drawings) has been reviewed for accuracy of equipment and system quality and component quantities. The available voltages have been coordinated with the electrical contractor. All coordination items with other trades have been completed including structural, electrical, and other mechanical division disciplines prior to ordering any equipment."

- C. 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 (found at the end of this section), Exhibit 1, entitled "Certification of Compliance - Shop Drawings" with each submittal prior to the index page and submittal data sheets. Failure to complete and execute this form will result in rejection of the submittal without review.
- D. Each individual submittal item shall be marked to show Specifications Section and Paragraph number which pertains to the item. Shop Drawings shall clearly indicate location, fixture no. or equipment designation, etc., so that the intended use of the equipment can be readily identified. Failure to make submittals accordingly shall be considered cause for rejection of shop drawings.
- E. Submittals shall be supported by descriptive material, such as catalog cuts, diagrams, certified performance curves and charts published by the manufacturer to show conformance to specification and drawing requirements, model numbers alone will not be acceptable. All literature shall clearly indicate the specified model number, options to be included, dimensions, arrangement, rating and characteristics of the proposed equipment. Capacities and ratings shall be based on conditions indicated or specified herein. Any deviations from specified equipment shall be clearly noted in red.
- F. The Engineer will review the shop drawings for errors in the Contractor's interpretation of the design intent only. Corrections or comments made on shop drawings during review shall not relieve the Contractor from compliance with requirements of the contract documents, plans and specifications. Review of shop drawings shall not relieve the Contractor from the responsibility for conforming and correlating all quantities and dimensions, coordinating his work with that of other trades, and performing his work in a safe and satisfactory manner.
- G. Review of shop drawings shall not permit any deviations from the plans and specifications nor shall it permit changes to the plans and specifications by the Engineer. Changes to or deviations from the contract documents are subject to the provisions of the General Conditions of the contract. Any required changes will then be issued by the Architect and executed by both the Owner and Contractor.

- H. Each individual submittal item shall be marked to show Specifications Section and paragraph number which pertains to the item. Shop Drawings shall clearly indicate location, fixture no. or equipment designation, etc., so that the intended use of the equipment can be readily identified. Shop drawings shall be submitted for each of the following items:

Fans	Fire & Smoke Dampers
Air Distribution Devices	Automatic Dampers
Roof Mounted Air Intake/Relief Hoods	Flexible Ductwork
Electric Heaters	Ductwork & Ductwork Construction
Duct Access Panels	Vibration Isolation Equipment
Gas Flue / Combustion Air Systems	Air-handling Units
Condensing Units	Fan-Coil Units
Manual Dampers	Roof Curbs
Pumps	Automatic Flow Control Valves
Boilers	Heat Exchangers
Chillers	
Thermometers	Pressure Gauges
Relief Valve	
Electric Heaters	Pipe Identification Systems
Plumbing Fixtures & Fittings	
Valves & Unions	
Access Covers & Panels	
Valve Schedules and Diagrams	
Gauges	
HVAC Pipe Accessories	
Bi-Polar Ionization Units	
Pipe Hangers, Supports & Accessories	Contractor Start up forms
Controls & Control Diagrams including Wiring Plans	
Pipe & Duct Insulation & Accessories	
All equipment and systems training forms, signed	

- I. For miscellaneous items not listed here, contractor shall submit shop drawings for approval, unless the item is to be provided and installed **exactly** as specified, without variance.
- J. **Contractor shall provide a sign in sheet for each piece of equipment requiring Owner training noted in division 15. Training required for all equipment including the following: Water heaters, tempering valves, circulating pumps, HVAC pumps, electric heaters, boilers, chillers, condensing units, heat pump units, air handling unit, fan-coil units, rooftop units, split systems, energy recovery units, commercial kitchen hood, residential and commercial hood fire suppression systems and HVAC controls (controls shall include BAS as well as any non- BAS controls, i.e. wall mounted timers and wall mounted switches).**
- K. Submit evidence of welders' qualifications prior to performing any welds.
- L. In addition, contractor shall prepare and submit dimensioned shop drawings (drawn at minimum 1/4"=1'-0" scale) of all ductwork, piping and equipment (HVAC & plumbing), typical sections through corridors, equipment platforms, pipe sleeves and other penetrations through slabs and walls for HVAC & plumbing rough-ins including fire and smoke walls. These shop drawings

shall be submitted on bond media equal to the number of copies of submittals required by the contract documents.

- M. Installation shop drawings (drawn at minimum 1/8"=1'-0" scale) shall be prepared for all under floor piping systems. These shop drawings shall be submitted for approval prior to installing any under slab piping.

### 3.11 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  - 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete".

### 3.12 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- C. Field Welding: Comply with AWS D1.1.
- D. All hangers and supports for Mechanical and plumbing piping systems shall comply with the supporting requirements of the 2006 International Building Code Seismic Category B and Occupancy Category 3.

### 3.13 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.

- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

### 3.14 CONSTRUCTION OBSERVATION

- A. Give Architect 2 days notice of all tests and observations.
- B. Conduct all tests to satisfaction of Architect or his authorized representative.
- C. The sub-contractor's license holder shall be present at inspections with the engineer.
- D. Make site available at all times for observation by Architect. Contractor shall uncover all concealed areas during construction observation.
- E. In addition, the following formal observations by Architect or his authorized representative shall be conducted for each building or part of building and site.
  - 1. Above floor work before being concealed or covered.
  - 2. Final observation after completion of work.

### 3.15 QUALITY CONTROL

- A. The Contractor shall correct all deficiencies in the work noted in site visit reports prior to re-inspection by the Engineer. Failure to make corrections and field verify prior to re-inspection of work that has failed to comply with the Contract Documents shall be subject to compensation as described in Section 01400 – "Quality Requirements", paragraph A.1.7.3.

### 3.16 FLASHING

- A. All pipe, ducts, flues, etc., passing through a roof and walls shall be flashed in an approved manner. Flashing shall be perfectly watertight. Flashing shall be provided under this sub-contract, for installation under the roofing division. Sheet lead flashing shall be minimum 6.0 lb. per square foot, with adjustable flashing boot, with minimum 30" square. Lead sanitary vent flashings shall be smoothly shaped and formed into the pipe penetrations to the full available maximum inside diameter of the pipe. The roof penetration/flashing system shall be coordinated and compatible with roofing manufacturers' system.

### 3.17 FREEZE PROTECTION

- A. Do not run piping in outside walls, ventilated attic or ceiling spaces, or in other locations subject to freezing conditions. Piping adjacent to exterior walls shall be in furred spaces or cavities, on the warm side of the building insulation barrier, with building insulation between the piping and the exterior wall. In attic or ceiling spaces, piping shall be on the warm side of insulation batts. Insulation of piping in and of itself shall not be considered adequate freeze protection.

Domestic water piping or non-potable water piping exposed to freezing conditions shall be insulated as specified, with aluminum weather jacket and electric heating cable, thermostatically controlled, as specified under section 15775.

### 3.18 AIR FILTERS

- A. The Contractor shall be responsible for maintenance of all filters until the final inspection of each phase of construction. The units shall not be operated without air filters at any time and filters shall not be allowed to become overloaded with dust or dirt.
- B. Upon completion of the project and immediately prior to acceptance by the Owner, the units shall be provided with clean filters.
- C. During construction, unit filters shall be periodically changed while the unit is in operation. This shall include unit filter as well as a filter media to be placed over the return grilles. The unit filter and filter media shall be dated at each replacement. If the ductwork or evaporator coil becomes dirty, the contractor shall clean the ductwork and coil. The contractor shall provide the owner a letter stating that all coils have been inspected and are clean at Substantial Completion.

### 3.19 SYSTEM ACCEPTANCE

- A. Reference section 01770 for general system acceptance requirements. HVAC systems shall include all air-side components including fans, air-handling units, and energy recovery units. Mechanical systems shall include all central plant components such as boilers, chillers, pumps, controls, etc.

### 3.20 CLOSEOUT DOCUMENTATION

- A. Close out completion shall be dependent upon satisfactory submittal of the following documents related to this contract: (Items shall be submitted in a binder with each section tabbed.)
  - 1. Permits and Certificates of Inspection.
  - 2. State Department of Labor, Certificate of Boiler Inspection and Operation Permit.
  - 3. Statement certifying that no systems, components or materials employed on the project contain asbestos in any form.
  - 4. Statement certifying that no flux, solder or fittings employed on the project contain lead.
  - 5. Factory start up, testing and adjustment reports for air conditioning units.
  - 6. Superintendents documented field reports for pipe testing.
  - 7. Certification of Owners personnel instruction.
  - 8. Evidence of Welders qualifications under ASME SECTION IX of the Pressure Vessels Code, with attached affidavit that all welds were made by certified personnel.
  - 9. Testing certificates indicating backfilled trenches under pavement, floors, walks or future construction have been compacted to minimum 95% dry proctor.
  - 10. Certificate of Insulation Compliance.
  - 11. HVAC System contractor's start-up forms and manufacturer's start-up certification letters. All HVAC equipment shall be operational 45 days prior to Substantial Completion. Refer to Exhibit 2 – A/C Contractor's Start-up Card at the end of this section.

12. Warranty Documentation for equipment.
13. One year warranty for entire project of work responsible for under this set of contract documents.

B. Reference section 01770 for general requirements.

### 3.21 PROJECT RECORD DOCUMENTS

- A. Record drawings shall be submitted that incorporate all changes to the contract, pre-bid and post-bid. Reference each specification section for the required manuals.
- B. As the work progresses, the Contractor shall maintain records and record all changes made daily on a set of contract mechanical drawings (HVAC & Plumbing) during the progress of the work. The in-progress set of marked-up drawings, clearly showing the nature and extent of all changes, shall be maintained in the construction office at the site and clearly marked "Record Drawings". The "Record Drawings" shall be up to date and available for use at time of any job site visit by the Engineer or Architect. The completed "Record Drawings" shall be turned over to the Architect upon completion and acceptance of the work. Final payment and "close-out" of the project shall be dependent upon receipt and acknowledgment of the completed "Record Drawings".
- C. The Engineer shall furnish to the Contractor electronic files in AutoCAD format of the Contract Mechanical Drawings for the Contractors' use in preparing a final electronic copy of the record drawings of all changes made including all project addenda and change order modifications. Drawing changes shall be identified as follows:
  1. The affected change shall be identified in an enclosed clouded area of a consistent color not used to indicate the noted change.
  2. Each cloud shall have an identifier adjacent to the cloud identifying the date and origin of the change (i.e., 1-12-06, Construction Directive, 1-12-06, Change Proposal, 1-12-06, Field Coordination, etc.).
  3. Refer to Specification Section 01781 – PROJECT RECORD DOCUMENTS for additional requirements for Record Drawings.
- D. Submittal for electronic Record Drawings shall be made on compact disk in AutoCAD format and accompany one (1) full size set of bond plots to Engineer in color on white background. Plots shall be generated from the CD of electronic files. Electronic file names and plot sheet numbering shall match Contract Document format.
- E. **The record "as-built" documents, including drawings and specifications, shall be stored on site in a metal cabinet during construction for use by Engineer and Contractor during site visits. Cabinet dimensions shall be approximately 36 x 24 x 8", and be a Grainger stock #6C716 or equal, Cabinet shall clearly bear the name and license number of the installing contractor for each division of work. Supervising contractor for each division shall be responsible for the maintenance of these documents. Cabinet shall be mounted permanently in mechanical room upon completion of project with copy of final "as-built documents", submittal data, and warranty information enclosed for use by Owners' maintenance personnel.**
- F. Reference section 01781 for general requirements.

- G. Refer to Section 15075 – MECHANICAL IDENTIFICATION for additional requirements for as built documentation for valves, cleanouts, and under slab piping.

3.22 OPERATION AND MAINTENANCE DATA

- A. Operation and maintenance manuals shall be submitted for all major HVAC, plumbing, and fire protection equipment. Reference each specification section for the required manuals.
- B. Reference section 01782 for general requirements.

END OF SECTION 15050

SECTION 15050 - Exhibit No. 1

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.

Sub Contractor:

By: \_\_\_\_\_ Date: \_\_\_\_\_

Ga. State License No (Required): \_\_\_\_\_

Title: \_\_\_\_\_

Company: \_\_\_\_\_

General Contractor:

By: \_\_\_\_\_ Date: \_\_\_\_\_

Title: \_\_\_\_\_

Company: \_\_\_\_\_



SECTION 15050 - Exhibit No. 2

A/C Contractor shall make out start-up cards for all heat and cool units as per start up card furnished below and shall furnish same before substantial completion inspection for each phase of construction. **All HVAC equipment and BAS shall have its start-up card complete 45 day prior to Substantial Completion. Refer to 01770 – CLOSEOUT PROCEDURES.**

**A/C CONTRACTOR'S START-UP CARD**

Dade County Schools

School Name \_\_\_\_\_

HVAC Contractor \_\_\_\_\_

Unit # \_\_\_\_\_

Unit Model Number \_\_\_\_\_ Unit Serial Number \_\_\_\_\_

**A/C EQUIPMENT**

Rated Volts - \_\_\_\_\_

Rated Amps - \_\_\_\_\_

**COOLING**

**HEATING**

Discharge Pressure \_\_\_\_\_

Suction Pressure \_\_\_\_\_

Return Air Temp. \_\_\_\_\_

Supply Air Temp. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**GAS FIRED EQUIPMENT**

(Boilers, etc.)

Unit # \_\_\_\_\_

Actual Manifold Pressure:

Mfg. Rated Manifold Pressure:

\_\_\_\_\_

\_\_\_\_\_

Actual Stack Pressure:

Rated Stack Pressure:

\_\_\_\_\_

\_\_\_\_\_

**ELECTRIC HEAT**

Unit # \_\_\_\_\_

Actual Volts

Rated Volts

Rated Amps

Actual Amps

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## **SECTION 15055 - MOTORS**

### **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 basic requirements for factory and field-installed motors.

#### **1.3 DEFINITIONS**

- A. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.
- B. Field-Installed Motor: A motor installed at Project site and not factory installed as an integral component of motorized equipment.

#### **1.4 SUBMITTALS**

- A. Product Data for Field-Installed Motors: For each type and size of motor, provide nameplate data and ratings; shipping, installed, and operating weights; enclosure type and mounting arrangements; size, type, and location of winding terminations; conduit entry and ground lug locations; and information on coatings or finishes.
- B. Shop Drawings for Field-Installed Motors: Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Include the following:
  - 1. Each installed unit's type and details.
  - 2. Nameplate legends.
  - 3. Diagrams of power, signal, and control wiring. Provide schematic wiring diagram for each type of motor and for each control scheme.

#### **1.5 QUALITY ASSURANCE**

- A. Source Limitations: Obtain field-installed motors through one source from a single manufacturer.
- B. Product Options for Field-Installed Motors: Drawings indicate size, profiles, and dimensional requirements of motors 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 NFPA 70.

## 1.6 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices and features that comply with the following:
  - 1. Compatible with the following:
    - a. Magnetic controllers.
    - b. Multispeed controllers.
    - c. Reduced-voltage controllers.
  - 2. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.
  - 3. Matched to torque and horsepower requirements of the load.
  - 4. Matched to ratings and characteristics of supply circuit and required control sequence.
- B. Coordinate motor support with requirements for driven load; access for maintenance and motor replacement; installation of accessories, belts, belt guards; and adjustment of sliding rails for belt tensioning.
- C. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

## PART 2 - PRODUCTS

### 2.1 MOTOR REQUIREMENTS

- A. Motor requirements apply to factory and field installed motors except as follows:
  - 1. Different ratings, performance, or characteristics for motor are specified in another Section.
  - 2. Motorized-equipment manufacturer requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.

### 2.2 MOTOR CHARACTERISTICS

- A. Motor Voltage and Phase: See Division 16 documents.
- B. Frequency Rating: 60 Hz.
- C. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
- D. Service Factor: 1.15 for open drip proof motors; 1.0 for totally enclosed motors.

- E. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
- F. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- G. Enclosure: Open drip proof for interior motors, totally enclosed for exterior motors.

## 2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium, as defined in NEMA MG 1.
- C. Stator: Copper windings, unless otherwise indicated.
  - 1. Multispeed motors shall have separate winding for each speed.
- D. Rotor: Squirrel cage, unless otherwise indicated.
- E. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: Match insulation rating, unless otherwise indicated.
- G. Insulation: Class F, unless otherwise indicated.
- H. Code Letter Designation:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- I. Enclosure: Cast iron for motors 7.5 hp and larger; rolled steel for motors smaller than 7.5 hp.
  - 1. Finish: Manufacturer's Standard.

## 2.4 SINGLE-PHASE MOTORS

- A. Type: One of the following, to suit starting torque and requirements of specific motor application:
  - 1. Permanent-split capacitor.
  - 2. Split-phase start, capacitor run.
  - 3. Capacitor start, capacitor run.
- B. Shaded-Pole Motors: For motors 1/20 hp and smaller only.
- C. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.
- D. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, pre-lubricated-sleeve type for other single-phase motors.

## 2.5 STARTERS

- A. Power controllers shall be provided for the equipment furnished under this specification. When not provided as a component of the equipment specified, external starters shall be provided under this division to control the equipment as outlined in the control specifications. Starters and contactors shall be constructed in accordance with the NEMA Standards. Starters shall have overload and running protection in each power phase.
- B. Voltage for holding coils shall not exceed 120 volts, unless otherwise specified: provide built-in transformers with fuses. Provide auxiliary contacts as required by control circuits.
- C. Starters shall be furnished with individual phase thermal overload protection, and with two (2) normally open auxiliary contacts, "Hand-Off-Auto" switch, 24 VAC coil, 24 VAC control transformer, and pilot light.
- D. All external starters shall have NEMA-4 rated enclosures for weatherproof operation and stainless-steel enclosure finish. External starter serving cooling tower two speed motor shall be two speed type.
- E. Motor starters shall be manufactured by Furnas, Square D, Westinghouse, Siemens, General Electric.
- F. Each starter shall be provided engraved laminated plastic nameplates describing the piece of equipment being served.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to receive field-installed motors for compliance with requirements, installation tolerances, and other conditions affecting performance.
- B. Examine roughing-in for conduit systems to verify actual locations of conduit connections before motor installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 FIELD-INSTALLED MOTOR INSTALLATION

- A. Anchor each motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and align with load transfer link.
- B. Install motors on concrete bases complying with Division 3.

### 3.3 VARIABLE SPEED DRIVE INSTALLATION

- A. Installation of drives shall be certified in writing by a representative of the manufacturer.

- B. Manufacturer's representative shall certify proper programming, installation and interface with related equipment including ALC Control System, and confirm proper operation of device, Start-up Certification. Start-up Certification sheet shall be complete showing program variables and set up. Any Defaults shall be listed. Certification shall be provided to the Architect/Owner prior to Substantial Completion.
- C. Provide owner Training and documentation of training shall be included in close-out documents.

#### 3.4 STARTER INSTALLATION

- A. Installation of starters shall be in accordance with the requirements of the latest NEC, and conform to the conditions indicated on the electrical documents.
- B. Installation shall be coordinated with work of other divisions to provide adequate clearances for service and operation.

END OF SECTION 15055

## SECTION 15060 - HANGERS & SUPPORTS

### 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 hangers and supports for mechanical system piping and equipment:
  - 1. Steel pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Fastener systems.
  - 5. Pipe stands.
  - 6. Equipment supports.
- B. Related Sections include the following:
  - 1. Division 5 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
  - 2. Division 13 Section "Fire-Suppression Piping" for pipe hangers for fire-protection piping.
  - 3. Division 15 Section "Mechanical Vibration and Seismic Controls" for vibration isolation devices.
  - 4. Division 15 Section "Pipe Expansion Fittings and Loops" for pipe guides and anchors.
  - 5. Division 15 Section(s) "Metal Ducts" for duct hangers and supports.

#### 1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Steel pipe hangers and supports.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
  - 1. Trapeze pipe hangers. Include Product Data for components.
  - 2. Metal framing systems. Include Product Data for components.
  - 3. Pipe stands. Include Product Data for components.
  - 4. Equipment supports.
- C. Welding certificates.

## 1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel." AWS D1.3, "Structural Welding Code--Sheet Steel." AWS D1.4, "Structural Welding Code--Reinforcing Steel." "ASME Boiler and Pressure Vessel Code: Section IX.
- B. Welding: Qualify procedures and personnel according to the following: AWS D1.1, "Structural Welding Code--Steel."
  - 1. AWS D1.2, "Structural Welding Code--Aluminum."
  - 2. AWS D1.3, "Structural Welding Code--Sheet Steel."
  - 3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
  - 4. ASME Boiler and Pressure Vessel Code: Section IX.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
  - 1. B-Line Systems, Inc.; a division of Cooper Industries.
  - 2. ERICO/Michigan Hanger Co.
  - 3. Anvil International.
  - 4. PHD Manufacturing, Inc.
- C. Galvanized, Metallic Coatings: Pre-galvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

### 2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

### 2.4 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.



- B. Manufacturers:
  - 1. B-Line Systems, Inc.; a division of Cooper Industries.
  - 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
  - 3. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

## 2.5 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Manufacturers:
    - a. B-Line Systems, Inc.; a division of Cooper Industries.
    - b. Hilti, Inc.
    - c. Powers Fasteners.

## 2.6 INTERMEDIATE PIPE SUPPORTS

- A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Low type, manufactured pipe stand assembly consisting of a plastic base unit with two vertical 1/2" galvanized threaded steel rods with nuts and washers for height adjustable to 10" minimum and horizontal roller strut support with contours for supporting pipe.
  - 1. Manufacturers:
    - a. MIRO Industries 4-RAH.
    - b. PHP Systems and Design SS8-R
    - c. Mapa Products
    - d. Dymotec Roof Top Blox RTB-01

## 2.7 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes. All supplementary supporting steel for work under this Division shall be provided under this Division of the specifications in accordance with the plans and accepted practices.

## 2.8 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Non-staining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30.
  - 2. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
  - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  - 5. C-Clamps (MSS Type 23): For structural shapes.
  - 6. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  - 7. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  - 8. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

### 3.2 HANGER AND SUPPORT INSTALLATION

#### A. SUSPENDED HORIZONTAL PIPING

1. Support Spacing
 

<u>NOMINAL PIPE SIZE</u>	<u>MATERIAL</u>	<u>MAXIMUM SPACING OF SUPPORTS</u>
Up through 1-1/2"	Steel & Copper	6'-0" – Unless Noted Otherwise
2" through 8"	Steel & Copper	8'-0" – Unless Noted Otherwise
3" through 5"	Cast Iron	5'-0"
6" and above	Cast Iron	5'-0"
All sizes	Plastic	4'-0"
2. In addition to the above maximum spacing requirements, hangers and supports shall be installed within 18" of each change in direction, regardless of pipe size or material.
3. Provide all hangers and rods, turnbuckles, angles, channels and other structural supports to support the piping systems. Rods for pipe hangers shall be as follows:
 

<u>HANGER ROD DIAMETER</u>	<u>PIPE SIZE</u>
3/8"	2" and smaller
1/2"	2-1/2" and 3"
5/8"	4" and 5"
3/4"	6"
7/8"	8", 10" and 12"
4. Intermediate pipe supports provided between building structural members so as not to exceed maximum support spacing specified (and to support 3" and larger pipe) shall be structural steel angles (minimum 2-1/2" X 2-1/2" X 1/4").
5. All ferrous metal pipe hangers and supplemental steel shall be provided with factory applied coat of rust inhibitive paint, plating or galvanizing.
6. Pipe hangers for suspending the following horizontal insulated piping shall be sized to fit around the pipe, pipe insulation and pipe insulation protective shields.
  - Cold water piping
  - Domestic hot water supply and recirculating piping
  - Hydronic heating hot water supply and return piping
  - Condensate drainage piping
  - Refrigerant Piping
7. All supporting equipment shall be designed with a minimum factor of safety of five based on the ultimate tensile strength of the materials employed.

- B. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

- C. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- E. Fastener System Installation:
  - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
  - 1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. No piping shall be installed directly to building structure.
- N. Pipe sleeves thru walls are not substitutions for pipe hangers.
- O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- P. Insulated Piping: Comply with the following:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
4. Shield Dimensions for Pipe:
  - a. Provide galvanized sheet metal pipe insulation protection shields at each pipe hanger for all horizontal insulated water pipes and condensate drain pipes. Shield sizes shall be:
    - 1) Pipes 2" and smaller: 18 gauge X 12" long
    - 2) Pipes 2-1/2" and larger: 16 gauge X 18" long
  - b. Shields shall be 180 degree type at all pipe hangers, except that on trapeze hangers, pipe rack and on floor supported horizontal pipe shields shall be 360 degree type. For pipe sizes 2-1/2" and larger, use Foamglass (Class insulation) inserts at all shields, hangers, sleeves, etc.
5. Pipes NPS 2-1/2" and Larger: Include wood or foamglass inserts.
6. Insert Material: Length at least as long as protective shield.

### 3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and 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. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

### 3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

### 3.6 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 15060

## SECTION 15075 - MECHANICAL 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 mechanical identification materials and their installation:
  - 1. Equipment labels.
  - 2. Pipe markers.
  - 3. Valve tags.
  - 4. Duct Access Doors

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Valve numbering scheme.

#### 1.4 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

#### 1.5 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Labels: Minimum 2" high black film adhesive backed letters.
  - 1. Data:
    - a. Name and plan number.

- b. Room number unit serves. Coordinate actual room numbers with Owner prior to labeling units.
    - c. Unit controllers shall be labeled with Room Number and module number.
  - 2. Location: Accessible and visible.
- B. Access Door Labels: 1" high black film adhesive backed letters.
  - 1. Data:
  - 2. Access door shall be labeled. The label shall indicate what unit the access door serves.
  - 3. Location: Accessible and visible.
- C. Water Heaters and Trap Primer Distribution Units: Minimum 2" high black film adhesive backed letters.
  - 1. Data: Heater tag number. (DWH-1..., GWH-1..., TPDU-1...)
  - 2. Location: Accessible and visible.
- D. Domestic Water Circulating Pumps, Trap Primer Valves, and Tempering Valves: Equipment tag attached to pump or valve body with jack chain and/or "S" hooks.
  - 1. Data: Equipment tag number. CP-1..., TP-1..., TV-1...)
  - 2. Location: Accessible and visible.
- E. Gas Pressure Regulators: Brass tags or engraved nameplates attached to regulator body with with jack chain and/or "S" hooks.
  - 1. Data: Equipment tag number. R-1...)
  - 2. Location: Accessible and visible.

## 2.2 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
  - 1. Colors: Comply with ASME A13.1, unless otherwise indicated.
  - 2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
  - 3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
  - 4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
  - 5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
- B. Self-Adhesive Pipe Markers not acceptable.
- C. Plastic Tape not acceptable.
- D. Manufacturers:
  - 1. T&B/ Westline
  - 2. Seton
  - 3. MSI (Marking Services, Inc.)
  - 4. Brimar Identification & Safety Products
  - 5. Brady Worldwide, Inc.

## 2.3 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme. Provide 5/32-inch hole for fastener.



1. Material: 19-gauge minimum brass, 1-1/2" minimum size.
2. Valve-Tag Fasteners: S hooks or jack chain.

B. Manufacturers:

1. T&B/ Westline
2. Seton
3. MSI (Marking Services, Inc.)
4. Brimar Identification & Safety Products
5. Brady Worldwide, Inc.

### PART 3 - EXECUTION

#### 3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 15 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

#### 3.2 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment labels on each major item of mechanical equipment, which includes all equipment that requires startup, and that does not have a nameplate or has a nameplate that is damaged or located where not easily visible. Locate labels where accessible and visible. Include nameplates for the following general categories of equipment:
1. Fuel-burning units, including boilers, furnaces, heaters, and absorption units.
  2. Fans, blowers, primary balancing dampers, and mixing boxes.
  3. Packaged HVAC central-station and zone-type units.
  4. VRF Refrigerant components.
  5. Roof mounted equipment including fans, rooftop units, energy recovery units and VRF systems.
  6. Equipment identification shall include unit number and room name and number it serves. If the unit serves multiple spaces the largest space shall be the identifying room. Room name abbreviations are acceptable with approval from Owner's representative. Example: RTU-1 (CLRM 123) or AHU-1 (CLRM 456) or AHU-2 (MEDIA 789)

#### 3.3 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
1. Pipes with OD, Including Insulation, Less Than 4 Inches: Snap-on/self coiling pipe markers. Use color-coded markers lapped at least 1-1/2 inches at both ends of pipe marker and covering full circumference of pipe.
  2. Pipes with OD, Including Insulation, 4 Inches and Larger: Snap-on/self coiling pipe markers. Use color-coded markers with permanent nylon fastener straps, one on each end.
- B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior non- concealed locations as follows:
1. Near each valve and control device.
  2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  3. Near penetrations through walls, floors, ceilings, and non-accessible enclosures.
  4. At access doors, manholes, and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 20 feet along each run or otherwise at each wall.
7. Pipe markings on piping more than 7'-0" above floor shall be rotated to allow full observation from floor.
8. In addition to sprinkler pipe identification required above ceilings, ID shall be installed at the Mechanical Platform
9. Gas piping on roof shall have pipe identification applied as specified with the following exceptions:
  1. Spacing on straight runs shall not exceed 50 feet.
  2. Only one pipe marker is required downstream of gas pressure regulator and shall be located within 10 feet of regulator.

C. Band and letter sizes shall conform to the following table:

<u>O.D. of Piping</u> <u>Covering:</u>	<u>Width of</u> <u>Color Band</u>	<u>Size of</u> <u>Letter/Numbers</u>
1" and smaller	6"	1/2"
1/4" to 2"	8"	3/4"
2-1/2" to 6"	12"	1-1/4"
8" and larger	18"	2"

D. Band legend and color and letter color shall conform to the following table:

<u>Piping</u>	<u>Band Legend</u>	<u>Letters</u>	<u>Band Color</u>
Non-Potable Water	NPW	White	Green
Natural Gas	G	Black	Yellow
Medium Pressure Gas	MPG	Black	Yellow
Domestic Cold Water	CW	White	Green
Domestic Hot Water	HW	Black	Yellow
Domestic Circulating	HWC	Black	Yellow
Condensate Drain	DRAIN	White	Green
Refrigerant	REF	Black	Yellow

### 3.4 VALVE-TAG INSTALLATION

A. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:

1. Valve-Tag Size and Shape:

<u>SYSTEM</u>	<u>IDENTIFICATION</u> <u>SHAPE</u>	<u>NUMBERS</u>
Cold Water (Domestic)	Round	CW-1,2,3.....
Hot Water (Domestic)	Round	HW-1,2,3.....

2. Each valve tag shall be attached to the hand wheel or lever handle with S hooks and/or jack chain.
3. A valve chart, framed under glass and wall mounted, shall be located in the main mechanical room and shall list each valve by identification number, its location in the piping system - (i.e., hot water, fire main, water heater, etc.) and its function - (i.e., shut-off, balancing, drain, etc.).
4. All ceiling tiles which provide access to valves shall be identified with a minimum 1/2" high valve identification number in black on clear adhesive backing affixed to the permanent ceiling grid immediately below the valve.

3.5 BURIED SANITARY AND STORM PIPING IDENTIFICATION

- A. Outside sanitary sewer and storm/downspout piping shall be identified with an acid and alkali resistant polyethylene film warning tape manufactured for marking and identifying underground sanitary and storm utilities. 4 mil thickness, 6" wide minimum identification tape with black letters on green background to read, "BUIRED SEWER LINE BELOW".
- B. Acceptable Manufacturers:
  - 1. Brimar Identification & Safety Products
  - 2. Seton
  - 3. MSI (Marking Services, Inc.)
  - 4. Brady Worldwide, Inc. - Identoline
- C. Tracer wire shall be a continuous No. 12 bare copper wire throughout the entire length of the buried PVC piping affixed to top of pipe with plastic cable ties on a minimum of 6-foot centers and within 12" of each change of direction.

3.6 PROJECT RECORD DOCUMENTS

- A. Valve tag identification numbers shall be shown on the as-built drawings adjacent to all valves shown on the contract documents and those added during the construction of the project and correspond exactly to the valve tag chart.
- B. All wall and floor cleanout identification numbers shall be shown on the as-built drawings adjacent to all cleanout locations shown on the contract documents and those added during the construction of the project. Identification numbers shall be marked on the back of all wall and floor cleanout covers to agree with video inspection report data.
- C. The Contractor shall provide all floor cleanout locations and identification numbers for under floor sanitary sewer kitchen waste, and storm/rainwater piping systems that match plumbing as-built documents to the third-party Contractor charged with video testing and documentation of under floor piping.
- D. All sanitary sewer piping installed below the building pad 4" and larger and with developed lengths exceeding 20 feet shall be dimensioned from column grid lines or face of walls on the as-built drawings.

3.7 ADJUSTING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.8 CLEANING

- A. Clean faces of mechanical identification devices.

END OF SECTION 15075

## SECTION 15080 - MECHANICAL 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 mechanical insulation for duct, equipment, and pipe, including the following:
  - 1. Insulation Materials:
    - a. Mineral fiber.
  - 2. Adhesives.
  - 3. Mastics.
  - 4. Sealants.
  - 5. Factory-applied jackets.
  - 6. Field-applied fabric-reinforcing mesh.
  - 7. Field-applied jackets.
  - 8. Tapes.
- B. Related Sections include the following:
  - 1. Division 15 Section "Metal Ducts" for duct liners.

#### 1.3 DEFINITIONS

- A. ASJ: All-service jacket.
- B. FSK: Foil, scrim, kraft paper.
- C. FSP: Foil, scrim, polyethylene.
- D. SSL: Self-sealing lap.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Shop Drawings: Show details for the following:
  - 1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Insulation application at pipe expansion joints for each type of insulation.
  - 3. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 4. Removable insulation at piping specialties, equipment connections, and access panels.
  - 5. Application of field-applied jackets.
  - 6. Application at linkages of control devices.

7. Field application for each equipment type.

- C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 15 Section "Hangers and Supports."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

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. Products: Subject to compliance with requirements, provide one of the products specified.
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 INSULATION MATERIALS

- A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied. All material shall comply with the minimum standards of the International Energy Code, with Georgia amendments, 2000 Edition.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
  - 1. Products:
    - a. CertainTeed Corp.; Duct Wrap.
    - b. Johns Manville; Microlite.
    - c. Knauf Insulation; Duct Wrap.
    - d. Manson Insulation Inc.; Alley Wrap.
    - e. Owens Corning; All-Service Duct Wrap.
- F. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation without factory-applied jacket. For equipment applications, provide insulation without factory-applied jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
  - 1. Products:
    - a. CertainTeed Corp.; Commercial Board.
    - b. Fibrex Insulations Inc.; FBX.
    - c. Johns Manville; 800 Series Spin-Glas.
    - d. Knauf Insulation; Insulation Board.
    - e. Manson Insulation Inc.; AK Board.
    - f. Owens Corning; Fiberglas 700 Series.
- G. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Products:
    - a. Fibrex Insulations Inc.; Coreplus 1200.
    - b. Johns Manville; Micro-Lok.
    - c. Knauf Insulation; 1000 Pipe Insulation.
    - d. Owens Corning; Fiberglas Pipe Insulation.
  - 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

## 2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Products:
    - a. Childers Products, Division of ITW; CP-82.

- b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.
- C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Products:
    - a. Childers Products, Division of ITW; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.
- D. PVC Jacket Adhesive: Compatible with PVC jacket.
  - 1. Products:
    - a. Dow Chemical Company (The); 739, Dow Silicone.
    - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
    - c. P.I.C. Plastics, Inc.; Welding Adhesive.
    - d. Red Devil, Inc.; Celulon Ultra Clear.
    - e. Speedline Corporation; Speedline Vinyl Adhesive.

## 2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
  - 1. Products:
    - a. Childers Products, Division of ITW; CP-35.
    - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
    - c. ITW TACC, Division of Illinois Tool Works; CB-50.
    - d. Marathon Industries, Inc.; 590.
    - e. Mon-Eco Industries, Inc.; 55-40.
    - f. Vimasco Corporation; 749.
  - 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
  - 5. Color: White.

## 2.5 SEALANTS

- A. Joint Sealants:
  - 1. Joint Sealants for Cellular-Glass Products:
    - a. Childers Products, Division of ITW; CP-76.
    - b. Foster Products Corporation, H. B. Fuller Company; 30-45.
    - c. Marathon Industries, Inc.; 405.
    - d. Mon-Eco Industries, Inc.; 44-05.
    - e. Pittsburgh Corning Corporation; Pittseal 444.
    - f. Vimasco Corporation; 750.
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Permanently flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 100 to plus 300 deg F.

5. Color: White or gray.
- B. FSK and Metal Jacket Flashing Sealants:
  1. Materials shall be compatible with insulation materials, jackets, and substrates.
  2. Fire- and water-resistant, flexible, elastomeric sealant.
  3. Service Temperature Range: Minus 40 to plus 250 deg F.
  4. Color: Aluminum.
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
  1. Materials shall be compatible with insulation materials, jackets, and substrates.
  2. Fire- and water-resistant, flexible, elastomeric sealant.
  3. Service Temperature Range: Minus 40 to plus 250 deg F.
  4. Color: White.

## 2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

## 2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.
- B. Woven Glass-Fiber Fabric for Duct and Equipment Insulation: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. inch for covering equipment.

## 2.8 FIELD-APPLIED JACKETS AND FITTING COVERS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  1. Products:
    - a. Johns Manville; Zeston.
    - b. P.I.C. Plastics, Inc.; FG Series.
    - c. Proto PVC Corporation; LoSmoke.
    - d. Speedline Corporation; SmokeSafe.
  2. Adhesive: As recommended by jacket material manufacturer.
  3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
  4. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
  5. Factory-fabricated tank heads and tank side panels.
- C. Metal Jacket:
  1. Products:
    - a. Childers Products, Division of ITW; Metal Jacketing Systems.



- b. PABCO Metals Corporation; Surefit.
- c. RPR Products, Inc.; Insul-Mate.
- 2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
  - a. Factory cut and rolled to size.
  - b. Finish and thickness are indicated in field-applied jacket schedules.
  - c. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
  - d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
  - e. Factory-Fabricated Fitting Covers:
    - 1) Same material, finish, and thickness as jacket.
    - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
    - 3) Tee covers.
    - 4) Flange and union covers.
    - 5) End caps.
    - 6) Beveled collars.
    - 7) Valve covers.
    - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available

## 2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.
  - 1. Products:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
    - b. Compac Corp.; 104 and 105.
    - c. Ideal Tape Co., Inc., an American Bilrite Company; 428 AWF ASJ.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  - 2. Width: 3 inches.
  - 3. Thickness: 11.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.
  - 1. Products:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    - b. Compac Corp.; 110 and 111.
    - c. Ideal Tape Co., Inc., an American Bilrite Company; 491 AWF FSK.
    - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
  - 2. Width: 3 inches.
  - 3. Thickness: 6.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.
  - 1. Products:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    - b. Compac Corp.; 120.
    - c. Ideal Tape Co., Inc., an American Bilrite Company; 488 AWF.

- d. Venture Tape; 3520 CW.
2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
  1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
  3. Proceed with installation only after unsatisfactory conditions have been corrected.
  4. Pressure test of piping shall be completed prior to insulation of piping.

#### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

#### 3.3 COMMON INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Manholes.
  - 5. Handholes.
  - 6. Cleanouts.
- Q. All domestic water piping in walls and chases shall be insulated unless otherwise noted on plans.

- R. No insulated or non-insulated domestic water piping shall be routed horizontally in masonry walls. Where pipe chases are provided route vertical and horizontal piping in chase. Where only walls are provided drop piping in open cell of block.
- S. All trap primer lines installed in walls and/or chases shall be wrapped or installed in a continuous polyethylene sleeve.

### 3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
  - 1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Through-Penetration Firestop Systems."
- C. Insulation Installation at Floor Penetrations:
  - 1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
  - 2. Pipe: Install insulation continuously through floor penetrations.
  - 3. Seal penetrations through fire-rated assemblies according to Division 7 Section "Through-Penetration Firestop Systems."

### 3.5 DUCT AND PLENUM INSULATION INSTALLATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
  - 1. Insulation shall be held in place with staples and U.L. listed pressure sensitive tape with additional #18-gauge stainless steel wire on 4 foot centers, to prevent sagging. All punctures in vapor barrier shall be sealed. All joints shall be lapped and wired. Staples and tape alone will not be acceptable.
- B. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
  - 1. On duct sides with dimensions larger than 36 inches, place pins 16 inches o.c. in each direction, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

### 3.6 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. No cover up of piping shall begin until the piping has been tested and verified to be free of leaks.
- C. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings under fitting covers made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- D. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- E. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.7 MINERAL-FIBER INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
  4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
  4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
  2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
  2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
  3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  4. Install insulation to flanges as specified for flange insulation application.
- E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. in each direction, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not over compress insulation during installation.
    - e. Impale insulation over pins and attach speed washers.
    - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1-inch o.c. Install vapor barrier

- consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
- a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
  - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
  6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
  7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- F. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not over compress insulation during installation.
    - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1-inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
  5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
  6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- G. Blanket Insulation Installation on rainwater, downspout and overflow drain piping and sumps (where piping is not exposed to view):
1. Secure with FSK tape and wire at 36" intervals along entire horizontal run of insulation.

2. Secure roof drain sump insulation with FSK tape. All metal surfaces of roof drain body, inclusive of under deck clamps shall be insulated.
  3. Tape applied to longitudinal seams shall be continuous.
  4. Horizontal downspout and overflow drain piping shall be insulated from underside of roof deck to 12" beyond elbow turned down in wall or chase.
- H. Insulation Installation on rainwater, downspout and overflow drain piping and sumps (where piping is exposed to view):
1. Insulate and finish piping the same as for domestic water piping system with the following additions:
    - a. Glass fiber mesh tape shall be wrapped continuous around the insulation cover throughout the entire pipe length.
    - b. Insulation surface shall have two coats of waterproof mastic applied.

### 3.8 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
  2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
  3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
  2. Install lap or joint strips with same material as jacket.
  3. Secure jacket to insulation with manufacturer's recommended adhesive.
  4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
  5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are required, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturers' recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.
- E. Where PVDC jackets are indicated, install as follows:
1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
  2. Wrap factory-pre-sized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install pre-sized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
  3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
  4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch- circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one



time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.

5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

### 3.9 FINISHES

- A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 painting Sections.
  1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

### 3.10 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
  1. Indoor, concealed supply and outdoor air.
  2. Indoor, exposed supply and outdoor air.
  3. Indoor, concealed return located in nonconditioned space.
  4. Indoor, exposed return located in nonconditioned space.
  5. Indoor, concealed energy recovery unit ductwork from the unit to exterior louver and ductwork from the unit to air device or connection to air handler.
  6. Indoor, exposed energy recovery unit ductwork from the unit to exterior. from the unit to air device or connection to air handler.
  7. Range hood exhaust ductwork to comply with NFPA 96 clearances.
- B. Items Not Insulated:
  1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1 unless noted otherwise on plans.
  2. Factory-insulated flexible ducts.
  3. Flexible connectors.
  4. Vibration-control devices.
  5. Factory-insulated access panels and doors.
  6. Exhaust ductwork connected to exhaust fans. (Energy recovery unit ductwork shall be insulated.)

### 3.11 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, round rectangular and flat-oval, supply-air and return-air duct insulation shall be the following:
  1. Mineral-Fiber Blanket: 2 inches thick and 0.75 lb./cu.ft. nominal density.
- B. Concealed, round rectangular, and flat-oval, outdoor-air and make-up duct insulation shall be any of the following:
  1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

- C. Concealed, return & supply-air plenum insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.
- D. Range hood exhaust ductwork shall comply with the following: Materials and methods complying with NFPA 96 and meeting local authority requirements.

### 3.12 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Fire-suppression piping.
  - 2. Drainage piping located in crawl spaces.
  - 3. Below-grade piping. (Except chilled water piping. Except copper piping shall have protective sleeve or coating).
  - 4. Chrome-plated pipes and fittings unless there is a potential for personnel injury.
  - 5. Pipe risers to water hammer arrestors/shock absorbers above ceiling.
  - 6. Trap Primer piping from distribution unit to drains on traps.

### 3.13 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
  - 1. 4" and Smaller: Insulation shall be the following:
    - a. Mineral-Fiber Pipe Insulation, Type I: 1 inch thick.
- B. Domestic Hot and Recirculated Hot Water:
  - 1. 2" and Smaller: Insulation shall be the following:
    - a. Mineral-Fiber Pipe Insulation, Type I: 1 inch thick.
  - 2. 2-1/2" and Larger: Insulation shall be the following:
    - a. Mineral-Fiber Pipe Insulation, Type I: 1 inch thick.
- C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
  - a. Mineral-Fiber Pipe Insulation, Type I: 1/2 inch thick.
- D. Condensate from HVAC Equipment and Equipment Drain Water below 60 Deg F:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Mineral-Fiber Pipe Insulation, Type I: 1/2 inch thick.
- E. Floor Drains, Traps, and Sanitary Drain Piping within 5 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Mineral-Fiber Pipe Insulation, Type I: 1/2 inch thick.
- F. Rainwater/Downspout and Overflow drain piping above ceilings inclusive of roof and overflow drain sumps.
  - 1. All pipe sizes: Insulation shall be the following:
    - a. Blanket fiberglass insulation 1-1/2" thick.
    - b. Mineral-Fiber Pipe Insulation, Type I: 1/2 inch thick. (where exposed to view)
- F. Refrigerant Suction and Hot-Gas Tubing: All pipe sizes, 1" thick flexible elastomeric or polyisofin.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
  - 1. PVC: 20 mils thick.
  - 2. Aluminum, Smooth or Corrugated: 0.020 inch thick.

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. Install jacket over all outdoor refrigerant piping. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
  - 1. Aluminum, Smooth or Corrugated: 0.020 inch thick.

3.16 OUTDOOR, ABOVE GROUND PIPING INSULATION:

Refrigerant Suction and Hot Gas Piping: All pipe sizes, 1" thick flexible elastomeric or polyisocyanurate.

END OF SECTION 15080

## SECTION 15110 - PLUMBING VALVES

### 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 general-duty valves:
  - 1. Bronze angle valves.
  - 2. Copper-alloy ball valves.
  - 3. Ferrous-alloy ball valves.
  - 4. Bronze check valves.
  - 5. Gray-iron swing check valves.
  - 6. Ferrous-alloy wafer check valves.
  - 7. Spring-loaded, lift-disc check valves.
  - 8. Bronze globe valves.
  - 9. Cast-iron plug valves.
- B. Related Sections include the following:
  - 1. Division 2 piping Sections for general-duty and specialty valves for site construction piping.
  - 2. Division 13 fire-suppression piping for fire-protection valves.
  - 3. Division 15 Section "Mechanical Identification" for valve tags and charts.
  - 4. Division 15 Section "HVAC Instrumentation and Controls" for control valves and actuators.
  - 5. Division 15 piping Sections for specialty valves applicable to those Sections only.

#### 1.3 DEFINITIONS

- A. The following are standard abbreviations for valves:
  - 1. CWP: Cold working pressure.
  - 2. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 3. NBR: Acrylonitrile-butadiene rubber.
  - 4. PTFE: Polytetrafluoroethylene plastic.
  - 5. SWP: Steam working pressure.
  - 6. TFE: Tetrafluoroethylene plastic.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.9 for building services piping valves.
  - 1. Exceptions: Domestic hot- and cold-water piping valves unless referenced.
- B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.
- D. All valves used in domestic water piping systems shall meet the Reduction of Lead in Drinking Water Act, Federal Act S.3874 for lead content.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set angle, gate, and globe valves closed to prevent rattling.
  - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
  - 5. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 VALVES, GENERAL

- A. Refer to Part 3 "Valve Applications" Article for applications of valves.
- B. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.
- C. Ferrous Valves: NPS 2-1/2 and larger with flanged ends, unless otherwise indicated.
- D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

- F. Valve Actuators:
  - 1. Hand wheel: For valves other than quarter-turn types.
  - 2. Lever Handle: For quarter-turn valves NPS 6 and smaller, except plug valves.
- G. Extended Valve Stems: On insulated valves.
- H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
  - 1. Valve Grooved Ends: AWWA C606.
  - 2. Solder Joint: With sockets according to ASME B16.18.
    - a. Caution: Use solder with melting point below 840 deg F for angle, check, gate, and globe valves; below 421 deg F for ball valves.
  - 3. Threaded: With threads according to ASME B1.20.1.
- I. Valve Bypass and Drain Connections: MSS SP-45.

## 2.3 BRONZE ANGLE VALVES

- A. Available Manufacturers:
  - 1. Type 1, Bronze Angle Valves with Metal Disc:
    - a. Crane Co.; Crane Valve Group; Stockham Div.
    - b. Hammond Valve.
    - c. Milwaukee Valve Company.
    - d. NIBCO INC.
  - 2. Type 2, Bronze Angle Valves with Nonmetallic Disc:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Crane Co.; Crane Valve Group; Stockham Div.
    - d. Grinnell Corporation.
    - e. Hammond Valve.
    - f. NIBCO INC.
  - 3. Type 3, Bronze Angle Valves with Metal Disc and Renewable Seat:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Crane Co.; Crane Valve Group; Stockham Div.
    - d. Grinnell Corporation.
    - e. Milwaukee Valve Company.
- B. Bronze Angle Valves, General: MSS SP-80, with ferrous-alloy hand wheel.
- C. Type 1, Class 150, Bronze Angle Valves: Bronze body with bronze disc and union-ring bonnet.
- D. Type 2, Class 150, Bronze Angle Valves: Bronze body with nonmetallic PTFE or TFE disc and union-ring bonnet.
- E. Type 3, Class 150, Bronze Angle Valves: Bronze body with bronze disc and renewable seat. Include union-ring bonnet.

## 2.4 COPPER-ALLOY BALL VALVES

- A. Acceptable Manufacturers:
  - 1. Two-Piece, Copper-Alloy Ball Valves (1/2" thru 3"):
    - a. Conbraco Industries, Inc.; Apollo Div.; 77CLF 100/200.

- b. Crane Co.; Crane Valve Group; Crane Valves; 9201/9202.
- c. Hammond Valve; UP8311A/8313A.
- d. Milwaukee Valve Company; UP450/450S.
- e. Kitz Valve Company; 868/869

B. Copper-Alloy Ball Valves, General: MSS SP-110.

C. Two-Piece, Copper-Alloy Ball Valves: Bronze body with full-port, chrome-plated ball; PTFE or TFE seats; and 600-psig CWP rating and blowout-proof stem.

## 2.5 FERROUS-ALLOY BALL VALVES

A. Acceptable Manufacturers:

- 1. Conbraco Industries, Inc.; Apollo Div.
- 2. Cooper Cameron Corp.; Cooper Cameron Valves Div.
- 3. Crane Co.; Crane Valve Group; Stockham Div.
- 4. Hammond Valve.
- 5. Milwaukee Valve Company.

B. Ferrous-Alloy Ball Valves, General: MSS SP-72, with flanged ends.

C. Ferrous-Alloy Ball Valves: Class 300, full port.

## 2.6 BRONZE CHECK VALVES

A. Manufacturers:

- 1. Type 1, Bronze, Horizontal Lift Check Valves with Metal Disc:
  - a. Cincinnati Valve Co.
  - b. Crane Co.; Crane Valve Group; Crane Valves.
  - c. Crane Co.; Crane Valve Group; Stockham Div.
  - d. Walworth Co.
- 2. Type 1, Bronze, Vertical Lift Check Valves with Metal Disc:
  - a. Cincinnati Valve Co.
  - b. Crane Co.; Crane Valve Group; Crane Valves.
  - c. Crane Co.; Crane Valve Group; Jenkins Valves.
- 3. Type 3, Bronze, Swing Check Valves with Metal Disc:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Crane Co.; Crane Valve Group; Stockham Div.
  - d. Grinnell Corporation.
  - e. Hammond Valve.
  - f. Milwaukee Valve Company.
  - g. Powell, Wm. Co.
  - h. Walworth Co.
  - i. Watts Industries, Inc.; Water Products Div.

B. Bronze Check Valves, General: MSS SP-80.

C. Type 1, Class 150, Bronze, Horizontal Lift Check Valves: Bronze body with bronze disc and seat.

D. Type 1, Class 150, Bronze, Vertical Lift Check Valves: Bronze body with bronze disc and seat.

- E. Type 2, Class 150, Bronze, Horizontal Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.
- F. Type 2, Class 150, Bronze, Vertical Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.
- G. Type 3, Class 150, Bronze, Swing Check Valves: Bronze body with bronze disc and seat.
- H. Type 4, Class 150, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.

## 2.7 GRAY-IRON SWING CHECK VALVES

- A. Manufacturers:
  - 1. Type I, Gray-Iron Swing Check Valves with Metal Seats:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Crane Co.; Crane Valve Group; Stockham Div.
    - d. Grinnell Corporation.
    - e. Hammond Valve.
    - f. Milwaukee Valve Company.
    - g. Mueller Co.
    - h. Watts Industries, Inc.; Water Products Div.
  - 2. Type II, Gray-Iron Swing Check Valves with Composition to Metal Seats:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Stockham Div.
    - c. Mueller Co.
    - d. Watts Industries, Inc.; Water Products Div.
- B. Gray-Iron Swing Check Valves, General: MSS SP-71.
- C. Type I, Class 250, gray-iron, swing check valves with metal seats.
- D. Type II, Class 250, gray-iron, swing check valves with composition to metal seats.

## 2.8 FERROUS-ALLOY WAFER CHECK VALVES

- A. Manufacturers:
  - 1. Single-Plate, Ferrous-Alloy, Wafer Check Valves:
    - a. McWane, Inc.; Kennedy Valve Div.
    - b. Mueller Co.
    - c. Tyco International, Ltd.; Tyco Valves & Controls.
  - 2. Dual-Plate, Ferrous-Alloy, Wafer Check Valves:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Stockham Div.
    - c. Grinnell Corporation.
    - d. Watts Industries, Inc.; Water Products Div.
  - 3. Dual-Plate, Ferrous-Alloy, Wafer-Lug Check Valves:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Gulf Valve Co.
    - c. Valve and Primer Corp.
  - 4. Dual-Plate, Ferrous-Alloy, Double-Flanged-Type Check Valves:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Gulf Valve Co.



- c. Techno Corp.
- B. Ferrous-Alloy Wafer Check Valves, General: API 594, spring loaded.
- C. Single-Plate, Class 125 or 150, Ferrous-Alloy, Wafer Check Valves: Flangeless body.
- D. Single-Plate, Class 125 or 150, Ferrous-Alloy, Double-Flanged Check Valves: Flanged-end body.
- E. Dual-Plate, Class 250 or 300, Ferrous-Alloy, Double-Flanged Check Valves: Flanged-end body.

## 2.9 SPRING-LOADED, LIFT-DISC CHECK VALVES

- A. Manufacturers:
  - 1. Type I, Wafer Lift-Disc Check Valves:
    - a. Mueller Steam Specialty.
  - 2. Type II, Compact-Wafer, Lift-Disc Check Valves:
    - a. Grinnell Corporation.
    - b. Hammond Valve.
    - c. Metraflex Co.
    - d. Milwaukee Valve Company.
  - 3. Type III, Globe Lift-Disc Check Valves:
    - a. Grinnell Corporation.
    - b. Hammond Valve.
    - c. Metraflex Co.
    - d. Milwaukee Valve Company.
  - 4. Type IV, Threaded Lift-Disc Check Valves:
    - a. Grinnell Corporation.
    - b. Metraflex Co.
    - c. Milwaukee Valve Company.
    - d. Watts Industries, Inc.; Water Products Div.
- B. Lift-Disc Check Valves, General: FCI 74-1, with spring-loaded bronze or alloy disc and bronze or alloy seat.
- C. Type I, Class 125, Wafer Lift-Disc Check Valves: Wafer style with cast-iron shell with diameter matching companion flanges.
- D. Type II, Class 125, Compact-Wafer, Lift-Disc Check Valves: Compact-wafer style with cast-iron shell with diameter made to fit within bolt circle.
- E. Type III, Class 125, Globe Lift-Disc Check Valves: Globe style with cast-iron shell and flanged ends.
- F. Type IV, Class 125, Threaded Lift-Disc Check Valves: Threaded style with bronze shell and threaded ends.

## 2.10 BRONZE GLOBE VALVES

- A. Manufacturers:
  - 1. Type I, Bronze Globe Valves with Metal Disc:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Crane Co.; Crane Valve Group; Stockham Div.
    - d. Grinnell Corporation.

- e. Hammond Valve.
  - f. Milwaukee Valve Company.
  - g. Powell, Wm. Co.
  - h. Walworth Co.
  - 2. Type 2, Bronze Globe Valves with Nonmetallic Disc:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Crane Co.; Crane Valve Group; Stockham Div.
    - d. Grinnell Corporation.
    - e. Hammond Valve.
    - f. McWane, Inc.; Kennedy Valve Div.
    - g. Milwaukee Valve Company.
    - h. Powell, Wm. Co.
    - i. Walworth Co.
  - 3. Type 3, Bronze Globe Valves with Renewable Seat and Metal Disc:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Crane Co.; Crane Valve Group; Stockham Div.
    - d. Grinnell Corporation.
    - e. Hammond Valve.
    - f. Milwaukee Valve Company.
    - g. Walworth Co.
- B. Bronze Globe Valves, General: MSS SP-80, with ferrous-alloy hand wheel.
- C. Type 1, Class 150, Bronze Globe Valves: Bronze body with bronze disc and union-ring bonnet.

## 2.11 CAST-IRON PLUG VALVES

- A. Manufacturers:
- 1. Lubricated-Type, Cast-Iron Plug Valves:
    - a. Milliken Valve Co., Inc.
    - b. Nordstrom Valves, Inc.
    - c. Olson Technologies; Homestead Div.
    - d. Walworth Co.
  - 2. Nonlubricated-Type, Cast-Iron Plug Valves:
    - a. General Signal; DeZurik Unit.
    - b. Anvil International.
    - c. Mueller Flow Technologies.
    - d. Tyco International, Ltd.; Tyco Valves & Controls.
- B. Cast-Iron Plug Valves, General: MSS SP-78.
- C. Class 125 or 150, lubricated-type, cast-iron plug valves.
- D. Class 125 or 150, nonlubricated-type, cast-iron plug valves.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE APPLICATIONS

- A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
  1. Shutoff Service: Ball, butterfly, or plug valves.
  2. Throttling Service: Angle, ball, butterfly, or globe valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Domestic Water Piping: Use the following types of valves:
  1. Angle Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
  2. Angle Valves, NPS 2-1/2 and Larger: Type II, Class 250, cast iron.
  3. Ball Valves, NPS 2 and Smaller: Two-piece, 400-psig CWP rating, copper alloy.
  4. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
  5. Lift Check Valves, NPS 2 and Smaller: Type 2, Class 150, horizontal, bronze.
  6. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 150, bronze.
  7. Spring-Loaded, Lift-Disc Check Valves, NPS 2 and Smaller: Type IV, Class 150.
  8. Globe Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
  9. Globe Valves, NPS 2-1/2 and Larger: Type I, Class 250, bronze-mounted cast iron.

### 3.3 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement.
- F. Install check valves for proper direction of flow and as follows:
  1. Swing Check Valves: In horizontal position with hinge pin level.

2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.

G. Lift Check Valves: With stem upright and plumb.

### 3.4 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

C. Soldered Joints: Use ASTM B 813, water-soluble, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

### 3.5 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 15110

## SECTION 15122 - METERS & GAUGES

### 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 meters and gages for mechanical systems:
  - 1. Thermometers.
  - 2. Gages.
  - 3. Test plugs.
  - 4. Flowmeters.
- B. Related Sections include the following:
  - 1. Division 2 Section "Water Distribution" for domestic and fire-protection water service meters outside the building.
  - 2. Division 2 Section "Natural Gas Distribution" for gas meters outside the building.
  - 3. Division 13 Section "Fire Suppression" system piping gauges.
  - 4. Division 15 Section "Domestic Water Piping" for domestic and fire-protection water service meters inside the building.
  - 5. Division 15 Section "Steam and Condensate Piping" for steam and condensate meters.
  - 6. Division 15 Section "Fuel Gas Piping" for gas meters inside the building.

#### 1.3 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated; include performance curves.
- B. Shop Drawings: Schedule for thermometers, gages and flowmeters indicating manufacturer's number, scale range, and location for each.
- C. Operation and Maintenance Data: For flowmeters to include in emergency, operation, and maintenance manuals.

## 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. Thermometer Test Wells: Wells shall be brass and as specified above and designed to accept either dial thermometer as specified above or test thermometer.
  3. Manufacturers: Trerice #L80030, Ashcroft, Weis, Moeller, Marsh, Weksler, Palmer, or approved equal.

### 2.2 BIMETALLIC-ACTUATED DIAL THERMOMETERS

- A. Manufacturers:
1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
  2. Ernst Gage Co.
  3. Trerice, H. O. Co.
  4. Weiss Instruments, Inc.
  5. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Description: Direct-mounting, bimetallic-actuated dial thermometers complying with ASME B40.3.
- C. Element: Bimetal coil.
- D. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- E. Pointer: Red metal.
- F. Window: Glass.
- G. Ring: Stainless steel.
- H. Connector: Adjustable angle type.
- I. Stem: Metal, for thermowell installation and of length to suit installation.
- J. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.
- K. Ranges: Manufacturer's standard comparable to the following:
- |                   |                     |
|-------------------|---------------------|
| Chilled Water     | 30 to 180 degrees F |
| Heating Hot Water | 30 to 240 degrees F |
| Tower Water       | 0 to 120 degrees F  |

### 2.3 THERMOWELLS

- A. Manufacturers: Same as manufacturer of thermometer being used.
- B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

## 2.4 PRESSURE GAGES

- A. Manufacturers:
  - 1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
  - 2. Ernst Gage Co.
  - 3. Terice, H. O. Co.
  - 4. Weiss Instruments, Inc.
  - 5. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
  - 1. Case: Dry type, drawn steel or cast aluminum, 4-1/2-inch diameter.
  - 2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
  - 3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
  - 4. Movement: Mechanical, with link to pressure element and connection to pointer.
  - 5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
  - 6. Pointer: Red metal.
  - 7. Window: Glass.
  - 8. Ring: Stainless steel.
  - 9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
  - 10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
  - 11. Range for Fluids under Pressure: Two times operating pressure.
- C. Pressure-Gage Fittings:
  - 1. Valves: NPS 1/4 brass or stainless-steel needle type.
  - 2. Syphons: NPS 1/4 coil of brass tubing with threaded ends.
  - 3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

## 2.5 TEST PLUGS/PORTS

- A. Manufacturers:
  - 1. Flow Design, Inc.
  - 2. Terice, H. O. Co.
  - 3. Superseal, Peterson
- B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.
- C. Minimum Pressure and Temperature Rating: The test plug shall be constructed of brass with neoprene valve core rated for 1000 psi working pressure and designed for screwed installation in a 1/4" (Female) half collar welded to pipe or container
- D. Core Inserts: One or two self-sealing rubber valves.
  - 1. Insert material for air, water, oil, or gas service at 20 to 200 deg F shall be CR.
  - 2. Insert material for air or water service at minus 30 to plus 275 deg F shall be EPDM.
- E. Test Kit: Furnish one test kit containing one pressure gage and adaptor, and carrying case. Pressure gage, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.
  - 1. Pressure Gage: Small bourdon-tube insertion type with 2- to 3-inch-diameter dial and probe. Dial range shall be 0 to 200 psig.
  - 2. Carrying case shall have formed instrument padding.

## 2.6 VENTURI FLOWMETERS

- A. Manufacturers:
  - 1. Flow Design, Inc.
  - 2. Griswold
  - 3. Illinois
- B. Description: Differential-pressure design for installation in piping; with calibrated flow-measuring element, separate flowmeter, hoses or tubing, valves, fittings and flowmeter, and system fluid. Overlay plates for dial to read GPM.
- C. Construction: Bronze, brass, or factory-primed steel; with brass fittings and attached tag with flow conversion data.
- D. Pressure Rating: 250 psig.
- E. Temperature Rating: 250 deg F.
- F. End Connections for NPS 2 and Smaller: Threaded.
- G. End Connections for NPS 2-1/2 and Larger: Flanged or welded.
- H. Range: Flow range of flow-measuring element and flowmeter shall cover operating range of equipment or system served.
- I. Portable Indicators: Differential-pressure type calibrated for connected flowmeter element and having two 12-foot hoses in carrying case.
  - 1. Scale: Gallons per minute.
  - 2. Accuracy: Plus or minus 2 percent between 20 and 80 percent of range.
- J. Operating Instructions: Include complete instructions with each flowmeter.

## 2.7 MANUAL BALANCING VALVES/FLOW METERING FOR PIPING MAINS

- A. Balancing valves or plug cocks shall be designed for a minimum of 175 psig water working pressure. Provide adjustable stops for valves to limit open position for valves 3/4" and larger.
- B. Balancing valves for 3/4" through 2" lines shall be ball or butterfly type with screwed end.
- C. Balancing valves for 2-1/2" and larger shall be lubricated type semi-steel body and flanged end; Rockwell Nordstrom Figure #143, Powell Figure #2201, Walworth Figure #1797.
- D. Manufacturers:
  - 1. Through 2": Milwaukee "Butterball #BB-FS100", or approved equal by Conbraco or Apollo.
  - 2. 3" and Larger: Rockwell-Nordstrom, Powell, Wal-worth, Homestead or approved equal.

## PART 3 - EXECUTION

### 3.1 THERMOMETER APPLICATIONS

- A. Install bimetallic-actuated dial thermometers in the following locations:
  - 1. Inlet and outlet of each hydronic boiler and chiller.



2. Install additional thermometers as indicated on the drawings.

B. Provide the following temperature ranges for thermometers:

1. Domestic Hot Water: 30 to 240 deg F, with 2-degree scale divisions.
2. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions
3. Heating Hot Water: 30 to 240 deg F, with 2-degree scale divisions.
4. Chilled Water: 0 to 100 deg F, with 2-degree scale divisions.

3.2 GAGE APPLICATIONS

- A. Install dry-case-type pressure gages for discharge of each pressure-reducing valve.
- B. Install dry-case-type pressure gages at chilled- and condenser-water inlets and outlets of chillers.
- C. Install dry-case-type pressure gages at suction and discharge of each pump.
- D. Install additional gages as indicated on the drawings.

3.3 INSTALLATIONS

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install thermowells with socket extending a minimum of 2 inches into fluid and in vertical position in piping tees where thermometers are indicated.
- C. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
- D. Install needle-valve and snubber fitting in piping for each pressure gage for fluids (except steam).
- E. Install needle-valve and syphon fitting in piping for each pressure gage for steam.
- F. Install test plugs in tees in piping.
- G. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters as prescribed by manufacturer's written instructions.
- H. Install flowmeter elements in accessible positions in piping systems.
- I. Install differential-pressure-type flowmeter elements with at least minimum straight lengths of pipe upstream and downstream from element as prescribed by manufacturer's written instructions.
- J. Install connection fittings for attachment to portable indicators in accessible locations.
- K. Install flowmeters as indicated on the drawings.

3.4 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

3.5 ADJUSTING

- A. Calibrate meters according to manufacturer's written instructions, after installation.
- B. Adjust faces of meters and gages to proper angle for best visibility.

3.6 INSTRUCTION

- A. Owner shall be instructed on the proper operation of all test and maintenance components. The test plug/port kit shall be handed over to the Owner in proper working condition at the completion of the project.

END OF SECTION 15122

**SECTION 15123 - REFRIGERANT PIPING**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes refrigerant piping used for air-conditioning applications.

**1.03 PERFORMANCE REQUIREMENTS**

- A. Line Test Pressure for Refrigerant R-410A:
  - 1. Suction Lines for Air-Conditioning Applications: 300 psig .
  - 2. Suction Lines for Heat-Pump Applications: 535 psig .
  - 3. Hot-Gas and Liquid Lines: 535 psig .

**1.04 SUBMITTALS**

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:
  - 1. Thermostatic expansion valves.
  - 2. Solenoid valves.
  - 3. Pressure-regulating valves.
- B. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

**1.05 QUALITY ASSURANCE**

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

**1.06 PRODUCT STORAGE AND HANDLING**

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

**1.07 COORDINATION**

- A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

**PART 2 - PRODUCTS**

**2.01 COPPER TUBE AND FITTINGS**

- A. Copper Tube: ASTM B 88, Type L or ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.

- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8.

## 2.02 VALVES AND SPECIALTIES

- A. Check Valves:
  - 1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
  - 2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
  - 3. Piston: Removable polytetrafluoroethylene seat.
  - 4. Closing Spring: Stainless steel.
  - 5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
  - 6. End Connections: Socket, union, threaded, or flanged.
  - 7. Maximum Opening Pressure: 0.50 psig .
  - 8. Working Pressure Rating: 500 psig .
  - 9. Maximum Operating Temperature: 275 deg F .
- B. Service Valves:
  - 1. Body: Forged brass with brass cap including key end to remove core.
  - 2. Core: Removable ball-type check valve with stainless-steel spring.
  - 3. Seat: Polytetrafluoroethylene.
  - 4. End Connections: Copper spring.
  - 5. Working Pressure Rating: 500 psig .
- C. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.
  - 1. Body and Bonnet: Plated steel.
  - 2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
  - 3. Seat: Polytetrafluoroethylene.
  - 4. End Connections: Threaded.
  - 5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24, 115, or 208-V ac coil.
  - 6. Working Pressure Rating: 400 psig .
  - 7. Maximum Operating Temperature: 240 deg F .
  - 8. Manual operator.
- D. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
  - 1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
  - 2. Piston, Closing Spring, and Seat Insert: Stainless steel.
  - 3. Seat Disc: Polytetrafluoroethylene.
  - 4. End Connections: Threaded.
  - 5. Working Pressure Rating: 400 psig .
  - 6. Maximum Operating Temperature: 240 deg F .
- E. Thermostatic Expansion Valves: Comply with ARI 750.
  - 1. Body, Bonnet, and Seal Cap: Forged brass or steel.
  - 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
  - 3. Packing and Gaskets: Non-asbestos.
  - 4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
  - 5. Suction Temperature: 40 deg F.
  - 6. Superheat: Adjustable.
  - 7. Reverse-flow option (for heat-pump applications).
  - 8. End Connections: Socket, flare, or threaded union.

9. Working Pressure Rating: 450 psig.
- F. Moisture/Liquid Indicators:
  1. Body: Forged brass.
  2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
  3. Indicator: Color coded to show moisture content in ppm.
  4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
  5. End Connections: Socket or flare.
  6. Working Pressure Rating: 500 psig .
  7. Maximum Operating Temperature: 240 deg F .
- G. Mufflers:
  1. Body: Welded steel with corrosion-resistant coating.
  2. End Connections: Socket or flare.
  3. Working Pressure Rating: 500 psig .
  4. Maximum Operating Temperature: 275 deg F .
- H. Liquid Accumulators: Comply with ARI 495.
  1. Body: Welded steel with corrosion-resistant coating.
  2. End Connections: Socket or threaded.
  3. Working Pressure Rating: 500 psig .
  4. Maximum Operating Temperature: 275 deg F .

## 2.03 REFRIGERANTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Atofina Chemicals, Inc.
  2. DuPont Company; Fluorochemicals Div.
  3. Honeywell, Inc.; Genetron Refrigerants.
  4. INEOS Fluor Americas LLC.
- B. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

## PART 3 - EXECUTION

### 3.01 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.
- B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type L, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
- C. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type L, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

### 3.02 VALVE AND SPECIALTY APPLICATIONS

- A. Provide a brass service valve at each connection to variable refrigerant terminals, variable refrigerant heat recovery roof modules, and branch selector boxes. Spare circuits at branch selector boxes shall have a service valve with capped end for future connection.
- B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

- C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
- D. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.
- E. Install thermostatic expansion valves as close as possible to distributors on evaporators.
  - 1. Install valve so diaphragm case is warmer than bulb.
  - 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
  - 3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- F. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.
- G. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

### 3.03 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. All refrigerant piping for variable refrigerant flow systems shall be in strict accordance with recommendations from the manufacturer. Contractor shall submit shop drawings indicating routing, pipe sizing and devices for review by the Engineer and for use by the Contractor during installation. Provide a brass service valve at each connection to variable refrigerant terminals, variable refrigerant heat recovery roof modules, and branch selector boxes. Spare circuits at branch selector boxes shall have a service valve with capped end for future connection.
- C. Install refrigerant piping according to ASHRAE 15.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Install piping adjacent to machines to allow service and maintenance.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Refer to Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operation" for solenoid valve controllers, control wiring, and sequence of operation.
- L. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

- M. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- N. Install refrigerant piping in protective conduit where installed belowground.
- O. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- P. Slope refrigerant piping as follows:
  - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
  - 2. Install horizontal suction lines with a uniform slope downward to compressor.
  - 3. Install traps and double risers to entrain oil in vertical runs.
  - 4. Liquid lines may be installed level.
- Q. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- R. Install pipe sleeves at penetrations in exterior walls and floor assemblies.
- S. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping."
- T. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- U. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.
- V. Seal pipe penetrations through exterior walls according to Division 07 Section "Joint Sealants" for materials and methods.
- W. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

#### 3.04 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
  - 1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
  - 2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.
- F. Mechanical joints: Approved methods and fittings include Parker, RLS and Zoomlock.

### 3.05 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
  - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
  - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1/2 : Maximum span, 60 inches ; minimum rod size, 1/4 inch .
  - 2. NPS 5/8 : Maximum span, 60 inches ; minimum rod size, 1/4 inch .
  - 3. NPS 1 : Maximum span, 72 inches ; minimum rod size, 1/4 inch .
  - 4. NPS 1-1/4 : Maximum span, 96 inches ; minimum rod size, 3/8 inch .
  - 5. NPS 1-1/2 : Maximum span, 96 inches ; minimum rod size, 3/8 inch .
  - 6. NPS 2 : Maximum span, 96 inches ; minimum rod size, 3/8 inch .
  - 7. NPS 2-1/2 : Maximum span, 108 inches ; minimum rod size, 3/8 inch .
  - 8. NPS 3 : Maximum span, 10 feet ; minimum rod size, 3/8 inch .
  - 9. NPS 4 : Maximum span, 12 feet ; minimum rod size, 1/2 inch .
- D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 2 : Maximum span, 10 feet ; minimum rod size, 3/8 inch .
  - 2. NPS 2-1/2 : Maximum span, 11 feet ; minimum rod size, 3/8 inch .
  - 3. NPS 3 : Maximum span, 12 feet ; minimum rod size, 3/8 inch .
  - 4. NPS 4 : Maximum span, 14 feet ; minimum rod size, 1/2 inch .

### 3.06 SYSTEM CHARGING

- A. Charge system using the following procedures:
  - 1. Install core in filter dryers after leak test but before evacuation.
  - 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers . If vacuum holds for 12 hours, system is ready for charging.
  - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig .
  - 4. Charge system with a new filter-dryer core in charging line.

### 3.07 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
  - 1. Open shutoff valves in condenser water circuit.
  - 2. Verify that compressor oil level is correct.
  - 3. Open compressor suction and discharge valves.
  - 4. Open refrigerant valves except bypass valves that are used for other purposes.



5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 15123

## SECTION 15140 - DOMESTIC WATER PIPING

### 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 domestic water piping inside the building.
- B. Related Sections include the following:
  - 1. Division 15 Section "Meters and Gages" for thermometers, pressure gages, and fittings.
  - 2. Division 15 Section "Domestic Water Piping Specialties" for water distribution piping specialties.
  - 3. Division 15 Section "Plumbing Valves" for valves.
  - 4. Division 15 Section "Mechanical Identification " for piping identification requirements.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing domestic water piping systems with 125 psig, unless otherwise indicated.

#### 1.4 SUBMITTALS

- A. Water Samples: Specified in Part 3 "Cleaning" Article.
- B. Field quality-control test reports.

#### 1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

### PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

- A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

## 2.2 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper.
  - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
  - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
  - 4. Manufacturers:
    - a. Cambridge Lee
    - b. Howell Metal
    - c. Cerro Flow Products
- B. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.
  - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
  - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
  - 4. Manufacturers:
    - a. Cambridge Lee
    - b. Howell Metal
    - c. Cerro Flow Products
- C. Wrought Copper and Copper Alloy Solder Joint Pressure Fittings:
  - 1. Copper Pressure Fittings: ASME/ANSI standard B16.18 cast copper-alloy or ASME B16.22, wrought-copper solder-joint fittings. Furnish wrought-copper fittings if indicated.
  - 2. Wrought-copper fittings must be NSF/ANSI 61 registered.
    - a. Cello Products
    - b. Elkhardt Products
    - c. Mueller Industries

## 2.3 VALVES

- A. Bronze and copper alloy, general-duty valves are specified in Division 15 Section "Plumbing Valves."
- B. Balancing and drain valves are specified in Division 15 Section "Domestic Water Piping Specialties."

## PART 3 - EXECUTION

### 3.1 PIPE AND FITTING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Under-Building-Slab, Domestic Water Piping on House Side of Water Meter, NPS 3/4" and Smaller: Soft copper tube, Type K; copper pressure fittings; no joints below slab.

- D. Aboveground Domestic Water Piping: Use the following piping materials:
  - 1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
- E. Non-Potable-Water Piping: Use the following piping materials for each size range:
  - 1. 1-1/2 and Smaller: Soft copper tube, Type K; copper pressure fittings; and soldered joints. No joints below slab.

### 3.2 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shutoff Duty: Use bronze ball valves for piping 3" and smaller.
  - 2. Throttling Duty: Use full port bronze ball valves for piping 2" and smaller.
  - 3. Hot-Water-Piping, Balancing Duty: Memory-stop balancing valves.
  - 4. Drain Duty: Hose-end drain valves.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use full port ball valves for piping 4" and smaller.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
  - 1. Install hose-end drain valves at low points in water mains, risers, and branches.
  - 2. Install stop-and-waste drain valves where indicated.
- D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping 2" and smaller. Balancing valves are specified in Division 15 Section "Domestic Water Piping Specialties."

### 3.3 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."
- C. Install water-pressure regulators downstream from shutoff valves. Water-pressure regulators are specified in Division 15 Section "Domestic Water Piping Specialties."
- D. Install domestic water piping level and plumb.

### 3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- B. Soldered Joints: Use ASTM B 813, water-soluble, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. Pipe hanger and support devices are specified in Division 15 Section "Hangers and Supports." Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
- B. Install supports according to Division 15 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
  - 2. NPS 1-1/2: 72 inches with 3/8-inch rod.
  - 3. NPS 2 thru NPS 3: 96 inches with 1/2-inch rod.
  - 4. NPS 4 thru NPS 6: 96 inches with 5/8-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve, and extend and connect to the following:
  - 1. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
  - 3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

### 3.7 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
  - 1. Do not enclose, cover, or put piping into operation until it has been inspected, tested and approved by authorities having jurisdiction (AHJ), the Owner, and the Building inspections department.
  - 2. Notification of Inspections shall include the Architect, Engineer, Building Inspections Department (AHJ) and the Owner. A notification of at least 48 hours shall be given before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

- a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
  3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
  4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction. All reports shall be submitted to the Architect with any required corrective action listed once test is completed.
- B. Test domestic water piping as follows:
1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
  2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four (4) hours. Leaks and loss in test pressure constitute defects that must be repaired.
  5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
  6. Prepare reports for tests and required corrective action.

### 3.8 ADJUSTING

- A. Perform the following adjustments before operation:
1. Close drain valves, hydrants, and hose bibbs.
  2. Open shutoff valves to fully open position.
  3. Open throttling valves to proper setting.
  4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
    - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
    - b. Adjust calibrated balancing valves to flows indicated.
  5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
  6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  7. Check plumbing specialties and verify proper settings, adjustments, and operation.

### 3.9 CLEANING

- A. Contractor shall provide signage at all potable water outlets where systems or portions of systems are being tested with date and duration of test(s) prior to commencement of disinfection procedure. Notification of system cleaning shall be sent to the Architect's office 24 hours prior to actual performance of work. A copy of the biological examination of the test results shall be sent to the Architect's office for review and approval.
- B. Clean and disinfect potable domestic water piping as follows:
1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
  2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:

- a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
  - b. Fill and isolate system according to either of the following:
    - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours. Open and close all valves in system several times during the retention period.
  - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time. Open and close all valves in the system several times during the flushing period.
  - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 15140

## SECTION 15145 - DOMESTIC WATER PIPING 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 domestic water piping specialties:
  - 1. Vacuum breakers.
  - 2. Backflow preventers.
  - 3. Water pressure-reducing valves.
  - 4. Balancing valves.
  - 5. Thermostatic Mixing Valves.
  - 6. Strainers.
  - 7. Outlet boxes.
  - 8. Hose bibbs.
  - 9. Wall hydrants.
  - 10. Drain valves.
  - 11. Water hammer arresters.
  - 12. Trap-seal primer valves.
  - 13. Trap-seal primer systems.
  - 14. Individual fixture water tempering valves.
  - 15. Roof hydrants.
- B. Related Sections include the following:
  - 1.
  - 2. Division 15 Section "Meters and Gages" for thermometers, pressure gages, and flow meters in domestic water piping.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For domestic water piping specialties 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.
- B. NSF Compliance:
  - 1. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Cash Acme.
    - b. Conbraco Industries, Inc.
    - c. Zurn Plumbing Products Group; Wilkins Div.
  - 2. Standard: ASSE 1001.
  - 3. Size: As required to match connected piping.
  - 4. Body: Bronze.
  - 5. Inlet and Outlet Connections: Threaded or sweat.
  - 6. Finish: Chrome plated.
- B. Hose-Connection Vacuum Breakers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Cash Acme.
    - b. Conbraco Industries, Inc.
    - c. Woodford Manufacturing Company.
  - 2. Vacuum breakers shall be provided on all outlets threaded for hose ends. Vacuum breakers shall be the screw on vandal proof type with hose outlet threads.

2.2 BACKFLOW PREVENTERS

- A. Dual-Check-Valve Backflow Preventers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Cash Acme.
    - b. Conbraco Industries, Inc.
    - c. Watts Industries, Inc.; Water Products Div.
  - 2. Dual Check Valves shall be ASSE approved dual check valve backflow preventers, bronze constructed with dual check assemblies and replaceable seals and union end.
- B. Hose-Connection Backflow Preventers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.
    - b. Watts Industries, Inc.; Water Products Div.
    - c. Woodford Manufacturing Company.
  - 2. Standard: ASSE 1052.
  - 3. Operation: Up to 10-foot head of water back pressure.

4. Inlet Size: NPS 3/4.
5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
6. Capacity: At least 3-gpm flow.

## 2.3 WATER PRESSURE-REDUCING VALVES

### A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Cash Acme.
  - b. Conbraco Industries, Inc.
  - c. Watts Industries, Inc.; Water Products Div.
2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Size: As shown on plans.
5. Body: Bronze body construction with removable strainer, threaded connections and renewable seats. Provide stainless steel spring, stainless steel adjusting screw and stainless-steel screws and fasteners throughout.
6. Flow rates and reduced pressure fall-off shall be within limits set by the applicable plumbing code.

## 2.4 BALANCING VALVES

### A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ITT Industries; Bell & Gossett Div.
  - b. NIBCO INC.
  - c. Cash/Acme
2. Type: Ball valve with two readout ports and memory setting indicator.
3. Body: Brass or bronze.
4. Size: Same as connected piping, but not larger than NPS 2.

## 2.5 THERMOSTATIC WATER MIXING VALVES (TEMPERING VALVE)

### A. Water-Temperature Limiting Devices:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - a. Conbraco Industries, Inc.
  - b. Leonard Valve Company.
  - c. Powers; a Watts Industries Co.
  - d. Symmons Industries, Inc.
  - e. Lawler Mfg. Co.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: 105 deg F.
9. Tempered-Water Design Flow Rate: As shown on plans.
10. Valve Finish: Rough bronze

11. Unit shall be factory tested.
12. Install per manufacturers' recommendations.
13. Install thermometer, if not part of unit, on tempered water discharge line.

## 2.6 STRAINERS FOR DOMESTIC WATER PIPING

### A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Drain: Factory-installed, hose-end drain valve.

## 2.7 OUTLET BOXES

### A. Clothes Washer Outlet Boxes:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Guy Gray Manufacturing Co., Inc.
  - b. Oatey.
  - c. Plastic Oddities; a division of Diverse Corporate Technologies.
  - d. Watts Industries, Inc.; Water Products Div.
2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate. Metal boxes shall be installed in rated walls with boxes rated for that installation.
4. Valves: Combination, valved fitting or separate hot- and cold-water, valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
5. Supply Shutoff Fittings: NPS ½ globe, or ball valves and NPS ½ copper, water tubing.
6. Drain: NPS 2 stand pipe and P-trap for direct waste connection to drainage piping.
7. Inlet Hoses: Two 60-inch- long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
8. Drain Hose: One 48-inch- long, rubber household clothes washer drain hose with hooked end routed to filter box prior to spilling into outlet box.

### B. Icemaker Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Acorn Engineering Company.
  - b. Oatey.
  - c. Plastic Oddities; a division of Diverse Corporate Technologies.
2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel or plastic box and faceplate. Metal boxes shall be installed in rated walls with boxes rated for that installation.
4. Valve: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 globe, or ball valve and NPS 1/2 copper, water tubing.

### C. Washing Machine Filter Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Environmental Enhancements Model LUV-R
  - b. Oatey
  - c. Plastic Oddities; a division of Diverse Corporate Technologies.

2. Mounting: Surface mount on wall bracket.
3. Material: Plastic filter enclosure and removable top.

## 2.8 HOSE BIBBS

- A. Hose Bibbs (HB):
1. Standard: ASME A112.18.1 for sediment faucets.
  2. Body Material: Bronze.
  3. Seat: Bronze, replaceable.
  4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
  5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
  6. Pressure Rating: 125 psig.
  7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
  8. Finish for Mechanical Platform or Equipment Rooms: Rough bronze, or chrome or nickel plated.
  9. Finish for Service Areas: Chrome or nickel plated.
  10. Finish for Finished Rooms: Chrome or nickel plated.
  11. Operation for Equipment Rooms: Wheel handle or operating key.
  12. Operation for Service Areas: Wheel handle.
  13. Operation for Finished Rooms: Operating key.
  14. Include operating key with each operating-key hose bibb.
  15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

## 2.9 WALL HYDRANTS

- A. Exterior Non-freeze Wall Hydrants (NFWH):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company.
    - b. MIFAB, Inc.
    - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - d. Woodford Manufacturing Company
    - e. Watts Industries
    - f. Wade Industries
  2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
  3. Pressure Rating: 125 psig.
  4. Operation: Loose key.
  5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
  6. Inlet: NPS 3/4.
  7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
  8. Box: Deep, flush mounting with cover.
  9. Box and Cover Finish: Cast bronze with polished nickel bronze.
  10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
  11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
  12. Operating Keys(s): One with each wall hydrant.
- B. Interior Wall Hydrants (WH):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company.
    - b. MIFAB, Inc.
    - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

- d. Woodford Manufacturing Company.
- e. Watts Industries
- f. Wade industries
2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants, less non-freeze features.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Inlet: NPS 3/4.
6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounting with cover.
8. Box and Cover Finish: Cast bronze with polished nickel bronze.
9. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
11. Operating Keys(s): One with each wall hydrant.

## 2.10 DRAIN VALVES

- A. Ball-Valve-Type, Hose-End Drain Valves:
  1. Standard: MSS SP-110 for full-port, two-piece ball valves.
  2. Pressure Rating: 400-psig minimum CWP.
  3. Size: NPS 3/4.
  4. Body: Copper alloy.
  5. Ball: Chrome-plated brass.
  6. Seats and Seals: Replaceable.
  7. Handle: Vinyl-covered steel.
  8. Inlet: Threaded or solder joint.
  9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

## 2.11 WATER HAMMER ARRESTERS

- A. Water Hammer Arresters (WHA or SA):
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. MIFAB, Inc.
    - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - c. Zurn Plumbing Products Group; Specification Drainage Operation.
    - d. Watts Industries
  2. Standard: PDI-WH 201.
  3. Type: Metal bellows.
  4. Size: PDI-WH 201, Sizes A through F.
  5. Piston type arrestors are not acceptable.

## 2.12 TRAP-SEAL PRIMER VALVES (TP)

- A. Supply-Type, Trap-Seal Primer Valves:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. MIFAB, Inc.
    - b. PPP Inc.

- c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.
8. See plans for application and locations.

## 2.13 TRAP PRIMER DISTRIBUTION SYSTEMS (TPDU)

### A. Trap-Seal Primer Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. PPP Inc. Prime-Time PT Series
  - b. Zurn Industries. Z-1020
  - c. Mifab MI-100
2. Standard: ASSE 1044,
3. Piping: NPS 3/4, ASTM B 88, Type L; copper, water tubing.
4. Cabinet: Surface-mounting steel box with steel cover.
5. Electric Controls: solenoid valve, EMS control module and manual override switch for 120-V ac power.
6. Vacuum Breaker: ASSE 1001.
7. Number Outlets: As shown on plans.
8. Size Outlets: NPS 1/2.

## 2.14 INDIVIDUAL FIXTURE, WATER TEMPERING VALVES

### A. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Lawler Manufacturing Company, Inc. – 911E/F
  - b. Leonard Valve Company. – TA-300
  - c. Powers; a Watts Industries Co. – ES 150
2. Standard: ASSE 1071 and ANSI Z358.1, thermostatically controlled water tempering valve.
3. Pressure Rating: 125 psig minimum, unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: 60-95 degree F. range adjustable with internal cold water bypass.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.
8. Tempered-Water Setting: 85 deg F.

## 2.15 ROOF HYDRANTS

### A. Roof Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Woodford RHY2-MS (Basis of Design)
  - b. Jay R. Smith
  - c. Mifab

2. Standard: ASSE 1052,
  3. Piping: NPS 1", ASTM B 88, Type L; copper, water tubing.
  4. Automatic draining with galvanized steel casing.
  5. Outlet Nozzle: 3/4" male hose thread.
  6. Lockable with adjustable linkage for lever tension.
- B. Install on roof in pre-manufactured pipe curb assembly flashed to roof with weather proof penetration. Unit shall be secured to roof deck.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
1. Locate backflow preventers in same room as connected equipment or system.
  2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
  3. Do not install bypass piping around backflow preventers.
- C. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- D. Install water control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- E. Install balancing valves in locations where they can easily be adjusted.
- F. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
1. Install thermometers and water regulators if specified.
  2. Install cabinet-type units recessed in or surface mounted on wall as specified.
  3. Install on wall accessible from floor.
- G. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve, solenoid valve.
- H. Install water hammer arresters in water piping according to PDI-WH 201 and accessible above ceilings. Install access panels where required in hard ceilings.
- I. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow. Valve shall be installed above accessible ceilings.
- J. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Ground equipment according to Division 16 Section "Grounding and Bonding."
- C. Connect wiring according to Division 16 Section "Conductors and Cables."

### 3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  - 1. Trap Primer Distribution Units
  - 2. Dual-check-valve backflow preventers.
  - 3. Water pressure-reducing valves.
  - 4. Calibrated balancing valves.
  - 5. Primary, thermostatic, water mixing valves.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 15 Section "Mechanical Identification."

### 3.4 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.
- D. Set field-adjustable temperature limit stops on faucets.
- E. Set field-adjustable discharge pressure to trap primer regulators to 20 psi delivery pressure.

END OF SECTION 15145



## SECTION 15150 - SANITARY WASTE AND VENT PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following for soil, waste, and vent piping inside the building:
  - 1. Pipe, tube, and fittings.
- B. PERFORMANCE REQUIREMENTS
- C. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 20-foot head of water.

#### 1.3 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and details.
- C. Field quality-control inspection and test reports.

#### 1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

### 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 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

## 2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888, for above grade sanitary waste and vent, and kitchen waste and vent All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF.
  - 1. Manufacturers:
    - a. Charlotte Pipe
    - b. Tyler Pipe
    - c. AB&I
- B. Shielded Couplings: ASTM 1540 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
  - 1. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
    - a. Manufacturers:
      - 1) Clamp-All Corp. - Model 80
      - 2) Husky – SD-2000
      - 3) Tyler Pipe; Soil Pipe Div.

## 2.4 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
  - 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
    - a. Manufacturers:
      - 1) Cambridge Lee
      - 2) Howell Metal
      - 3) Cerro Flow Products

## 2.5 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
  - 1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Series PS 100 sewer and drain pipe.
    - a. Manufacturers:
      - 1) Charlotte Pipe & Foundry Co.
      - 2) Sanderson
      - 3) Lasco
      - 4) Tigre

## PART 3 - EXECUTION

### 3.1 EXCAVATION AND BACKFILL

- A. Perform all excavation and backfilling for work included in Division 15 of the specifications.

### 3.2 EXCAVATION

- A. Excavations shall be performed in strict accordance with latest OSHA regulations. Sheet piling, bracing, barricades and fencing shall be installed wherever necessary to avoid undue hazards to workmen or passersby.
- B. During excavation, material shall be piled at a distance from the banks of the excavation that will avoid overloading and will prevent slides and/or cave-ins. Water accumulating in excavations shall be removed by pumping. Unless otherwise indicated, excavation shall be by open cut except that short sections of a trench may be tunneled under sidewalks and curbs where pipe can be installed as specified and back-fill can be tamped. All trenches and pit excavations shall be shored and/or braced as required to prevent slides and/or cave-ins.
- C. The bottom of the trenches shall be graded to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length, except for the portions of the pipe sections where it is necessary to excavate for bell holes and the making of pipe joints. Bell holes and depressions for joints shall be dug after the trench bottom has been graded. Over-depths shall be backfilled as specified and with materials for backfilling as specified.

### 3.3 BACKFILLING

- A. The trenches shall not be backfilled until all required pressure and/or leak tests on piping are performed and until the mechanical systems as installed conform to requirements specified in the several sections covering the installation of the various systems. Trenches shall be backfilled to the ground surface with clean, selected excavated material or other material that meets compaction requirements and as hereinafter specified. Pavement and base course disturbed by trenching operation shall be restored to its original condition.
- B. Backfill material shall be deposited in 6-inch thick layers and compacted with mechanical tamps to the density of the adjacent soil or grade until there is a cover of not less than 2 feet over pipes. The backfill material in this portion of the trench shall consist of earth, sandy clay, soft shale, or other materials free from objects larger than 1 inch in any direction.
- C. The remainder of the trench shall be backfilled with clean, select material that is free of stones larger than 3 inches in any direction. Backfill material shall be deposited in layers not exceeding 6 inches thick, and each layer shall be compacted mechanically. Settling of granular, non-cohesive material with water will be permitted. The surface shall be mounded over for settling and left in a uniform condition.

### 3.4 COMPACTION AND TESTING

- A. Areas under building locations, paving, walks or other structures which may be placed on site at a future date shall be compacted to 95% minimum dry proctor.

### 3.5 PIPING APPLICATIONS

- A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- B. Aboveground, soil and waste and kitchen waste piping 10" and smaller shall be the following:
  - 1. Hubless cast-iron soil pipe and fittings heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
  - 2. Copper DWV tube, copper drainage fittings, and soldered joints.

- C. Aboveground, sanitary vent and kitchen vent piping 6" and smaller shall be the following:
  - 1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
- D. Underground, soil, waste, and vent piping and kitchen waste and vent piping 10" and smaller shall be the following:
  - 1. Solid-wall PVC pipe with PVC socket fittings and solvent weld joints.

### 3.6 PIPING INSTALLATION

- A. Sanitary sewer piping outside the building is specified in Division 2 Section "Sanitary Sewerage."
- B. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- C. Install seismic restraints on piping where called for on plans or as required by Code for Site Classification listed. Seismic-restraint devices are specified in Division 15 Section "Mechanical Vibration Control."
- D. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- E. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- F. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- G. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- H. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
  - 1. Building Sanitary Drain: 1 percent downward in direction of flow for piping NPS 3 and smaller or 2 percent where called for on plans; 1 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Horizontal Sanitary Drainage Piping: 1 percent downward in direction of flow or 2 percent where called for on plans.
  - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- I. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- J. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- K. Install PVC sanitary drainage piping according to ASTM D 2665.

- L. Install underground PVC sanitary drainage piping according to ASTM D 2321.
- M. No horizontal piping shall be installed in the slab.

### 3.7 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
- D. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- E. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- F. PVC Non-pressure Piping Joints: Join piping according to ASTM D 2665.

### 3.8 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 15 Section "Mechanical Vibration Control."
- B. Pipe hangers and supports are specified in Division 15 Section "Hangers and Supports." Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Install individual, straight, horizontal piping runs according to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer than 100 feet: MSS Type 43, adjustable roller hangers.
    - c. Longer than 100 feet, if indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 15 Section "Hangers and Supports."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  - 2. NPS 3: 60 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  - 4. NPS 6: 60 inches with 3/4-inch rod.
  - 5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.

- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
  - 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
  - 5. NPS 6: 10 feet with 5/8-inch rod.
  - 6. NPS 8: 10 feet with 3/4-inch rod.
- I. Install supports for vertical copper tubing every 10 feet.
- J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.9 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect drainage and vent piping to the following:
  - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
  - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
  - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

### 3.10 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 48 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Water test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
  4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
  5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  6. Prepare reports for tests and required corrective action.
- E. Video camera testing shall be performed on sanitary waste and kitchen waste systems below building slab and to connection at sanitary sewer manhole or grease trap. Refer to section 15960 "Plumbing Systems Testing" requirements, procedures and reporting.

### 3.11 UNDERGROUND PIPING IDENTIFICATION

- A. All above ground sanitary waste and vent piping shall be identified with pipe identification labels as specified in Division 15 Section "Mechanical Identification".
- B. All underground PVC sanitary waste and vent piping installed outside the building pad shall have continuous warning identification tape installed 12" above the top of the pipe and a minimum of 6" below finished grade.
- C. All exterior underground PVC piping shall have a continuous tracer wire installed on the top of the pipe and attached with cable ties on 6' centers maximum spacing and within 12" from tees, branch connections and manufactured elbows.

### 3.12 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 15150

## SECTION 15155 - DRAINAGE PIPING 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 drainage piping specialties:
  - 1. Cleanouts.
  - 2. Floor drains.
  - 3. Roof flashing assemblies.
  - 4. Through-penetration firestop assemblies.
  - 5. Miscellaneous drainage piping specialties.
  - 6. Solids Interceptors.
  - 7. Downspout nozzles.
- B. Related Sections include the following:
  - 1. Division 15 Section "Plumbing Fixtures" for hair/solids interceptors.

#### 1.3 DEFINITIONS

- A. PE: Polyethylene plastic.
- B. PVC: Polyvinyl chloride plastic.

#### 1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary and storm piping specialty components.

#### 1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Coordinate size and location of roof penetrations.
- C. Coordinate locations of wall cleanouts so as not to be located behind casework or cabinets.



## PART 2 - PRODUCTS

### 2.1 CLEANOUTS

- A. Cleanouts shall be provided where shown on the drawings, and as required by the applicable plumbing code. All wall and floor cleanouts shall have access cover and cleanout plugs removed at time of final project review.
- B. Cleanouts on under floor drainage piping shall have piping extended to the floor and finished with cleanout plug and removable floor plate.
- C. Cleanouts installed in carpeted areas shall have carpet marker and securing screw.
- D. Cleanouts in waterproofed floors or overhead slabs shall have flashing clamps.
- E. Stainless steel, phillips head screws shall be used to secure all floor and wall cleanout covers, and all floor drain grates and strainer tops.
- F. Cleanouts in vertical piping shall be roughed with centerline not more than 1'-6" above the finished floor, but high enough for escutcheon cover to clear the baseboard.
- G. For Walls: Cleanouts shall be no-hub cleanout tee with bronze countersunk plug tapped for machine screw with shallow stainless-steel face-of wall access cover.
- |    |                |           |
|----|----------------|-----------|
| 1. | Jay R. Smith   | 4510-Y    |
| 2. | Josam          | 58790     |
| 3. | Wade           | 8560E     |
| 4. | Zurn           | Z-1446-BP |
| 5. | Watts Drainage | CO 460 RD |
- H. For Concrete Floors: Cleanouts shall have cast iron body, adjustable round scoriated nickel bronze cover and rim, stainless steel securing screws and countersunk taper threaded bronze plug.
- |    |                |             |
|----|----------------|-------------|
| 1. | Jay R. Smith   | 4028C-U-PB  |
| 2. | Josam          | 56000-15-22 |
| 3. | Wade           | W-6010-75   |
| 4. | Zurn           | Z-1405-2    |
| 5. | Watts Drainage | CO 200 R    |
- I. Yard Cleanouts: Cleanouts shall have tractor weight cast iron housing, stainless steel securing screws and countersunk bronze plug. Cleanouts shall be set in a 16" X 16" X 6" deep poured concrete pad set flush with grade.
- |    |                |                 |
|----|----------------|-----------------|
| 1. | Jay R. Smith   | 4243-U          |
| 2. | Josam          | 56050-22        |
| 3. | Wade           | 7030-2          |
| 4. | Zurn           | Z1450-1         |
| 5. | Watts Drainage | CO 200 RX-4-34B |
- J. All wall and floor cleanout covers shall be marked on the back of the cover with an identification tag number with a black permanent marker 1/8" minimum width letters/numbers and minimum 3/4" high lettering for the purpose of video inspections report tracking. See section 15960 "Plumbing Systems Testing"
- K. Two (2) cleanout plug and two (2) cleanout cover removal tools for each type of cleanout plug and cleanout cover shall be installed on the wall of the main mechanical room at close-out of project for use

by school personnel. Cleanout tools shall be turned over to the Architect and signed for prior to substantial completion.

- L. Immediately prior to Owner's final review, all cleanout plugs shall be removed from cleanouts on the final project review to assure Owner that cleanout plug can be removed without any obstructions. Apply anti-seize lubricant to all threads of cleanout plugs and replace cleanout plugs and access covers immediately following Owner's final review.
  - 1. Acceptable manufacturers of anti-seize lubricants:
    - a. Fel-Pro C5-A
    - b. Rectorseal Break-out
    - c. Lub-O-Seal Never-seez

## 2.2 FLOOR DRAINS

- A. FD-1:
  - 1. Floor drains shall have a cast iron body and flashing flange with adjustable 6" round nickel bronze strainer, stainless steel securing screws, sediment bucket and trap primer connection.
  - 2. Floor drains on mechanical platform shall not have sediment buckets installed.
  - 3. Drains shall be: Jay R. Smith 2010-A-B-P050 or approved equal by Josam, Mifab, Zurn, Wade or Watts Drainage.
- B. FD-2:
  - 1. Floor drain shall have coated cast iron body and flashing flange, 7" round nickel bronze strainer with stainless steel securing screws, and anti splash collar.
  - 2. Drains shall be: Jay R. Smith 2010-A-F-37 or approved equal by Josam, Mifab, Zurn, Wade or Watts Drainage.
- C. FD-3: (Mechanical Rooms):
  - 1. Drain shall be coated cast iron body and cast-iron flashing clamp, 9" diameter adjustable cast iron grate with stainless steel securing screws, sediment bucket and 1/2" trap primer tapping.
  - 2. Drains shall be: Jay R. Smith 2350-B-P050 or approved equal by Josam, Mifab, Zurn, Wade or Watts Drainage.
- D. FD-4: (Trench Drain):
  - 1. Drain shall be a modular trench drain with cast iron flanged body with 3" bottom outlet, deep hub and stainless-steel bucket strainer. Grate tops to be heavy duty cast iron. Maximum length of grate top section is 12". Nominal drain size is 24"x12"
  - 2. Drain shall be: Jay R. Smith 2711-2-DH-BSS or approved equal by Josam, Mifab, Zurn, Wade or Watts Drainage.
- E. FS-1: (Floor Sink):
  - 1. Drain shall be cast iron body, acid resistant coated with 8-1/2" square nickel bronze top, stainless steel securing screws, dome bottom strainer, minimum 6" deep with 3" outlet.
  - 2. Drains shall be: Jay R. Smith 3100-13 or approved equal by Josam, Mifab, Zurn, Wade or Watts Drainage.
  - 3. Provide top grate/cover options as called for on plans.
- F. FFD: (Funnel Floor Drain):
  - 1. Drain shall have a cast iron body and cast-iron flashing flange with adjustable 6" round nickel bronze strainer with stainless steel securing screws, and funnel attached to grate top.
  - 2. Drain shall be: Jay R. Smith 2010-A/Fig. 3580-NB or approved equal by Josam, Mifab, Zurn, Wade or Watts Drainage.

## 2.3 ROOF FLASHING ASSEMBLIES

- A. Roof Flashing Assemblies:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Acorn Engineering Company; Elmdor/Stoneman Div.
    - b. Thaler Metal Industries, Ltd
    - c. Zilla Flashing Products, Inc.
- B. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch-thick, lead flashing collar and skirt extending at least 10 inches from pipe, with galvanized-steel boot reinforcement and counter flashing fitting.

## 2.4 ROOF DRAINS

- A. Metal Roof Drains (RD):
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Josam Div.
    - b. MIFAB, Inc.
    - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - d. Zurn Plumbing Products Group; Specification Drainage Operation.
    - e. Watts Drainage
  - 2. Standard: ASME A112.21.2M.
  - 3. Pattern: Roof drain.
  - 4. Body Material: Cast iron.
  - 5. Dimensions of Body: Nominal 15" drain.
  - 6. Combination Flashing Ring and Gravel Stop: Required
  - 7. Flow-Control Weirs: Not required.
  - 8. Outlet: Bottom.
  - 9. Dome Material: Cast iron.
  - 10. Extension Collars: Required.
  - 11. Under deck Clamp: Required.
  - 12. Sump Receiver: Required.

## 2.5 OVERFLOW ROOF DRAINS

- A. Metal Overflow Roof Drains (OFD):
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Josam Div.
    - b. MIFAB, Inc.
    - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - d. Zurn Plumbing Products Group; Specification Drainage Operation.
    - e. Watts Drainage
  - 2. Standard: ASME A112.21.2M.
  - 3. Pattern: Roof drain.
  - 4. Body Material: Cast iron.
  - 5. Dimensions of Body: Nominal 15" drain.
  - 6. Combination Flashing Ring and Gravel Stop: Required
  - 7. Flow-Control Weirs: 3" high.
  - 8. Outlet: Bottom.
  - 9. Dome Material: Cast iron.
  - 10. Extension Collars: Required.

11. Under deck Clamp: Required.
12. Sump Receiver: Required.

## 2.6 MISCELLANEOUS DRAINAGE PIPING SPECIALTIES

- A. Deep-Seal Traps:
1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
  2. Size: Same as connected waste piping.
    - a. NPS 2: 4-inch- minimum water seal.
    - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.
- B. Floor-Drain, Trap-Seal Primer Fittings:
1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
  2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

## 2.7 SOLIDS INTERCEPTORS

- A. Solids Interceptors: (Art Rooms)
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Josam Div.
    - b. MIFAB, Inc.
    - c. Schier Products Company.
    - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  2. Type: Factory-fabricated interceptor made for removing and retaining lint from wastewater.
  3. Body Material: Cast iron.
  4. Interior Separation Device: Perforated strainer basket.
  5. Interior Lining: Corrosion-resistant enamel.
  6. Exterior Coating: Corrosion-resistant enamel.
  7. Inlet and Outlet Size: 1-1/2".
  8. End Connections: Threaded.
- B. Solids Interceptors: (Kitchen)
1. Manufacturers: Subject to compliance with requirements, provide Jay R. Smith model no. 8874-34 (in floor) or Mifab MI-SOLID-SA (above floor) or an equal product by one of the following:
    - a. Josam Company; Josam Div.
    - b. MIFAB, Inc.
    - c. Schier Products Company.
  2. Type: Factory-fabricated interceptor made for removing and retaining solids from wastewater.
  3. Body Material: Cast iron/14 gage stainless steel
  4. Interior Separation Device: Removable perforated strainer basket.
  5. Interior Lining: Corrosion-resistant enamel.
  6. Exterior Coating: Corrosion-resistant enamel.
  7. Inlet and Outlet Size: 2".
  8. End Connections: Threaded.

## 2.8 DOWNSPOUT NOZZLES

- A. Overflow roof drain piping shall terminate thru exterior wall high in a downspout nozzle sized as shown on plans. Locate in plan and elevation as indicated on Architectural plans. Nozzle shall be a cast bronze

body with wall flange for mounting on exterior wall at minimum 3 places. Cast iron overflow drain piping shall be threaded to screw into nozzle.

- B. Manufacturers: Jay R. Smith 1770, Zurn Z-199, Josam 25010 or Wade 3940.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  2. Locate at each change in direction of piping greater than 45 degrees.
  3. Locate at maximum intervals of 50 feet for piping NPS 3 and smaller and 100 feet for larger piping.
  4. Locate at base of each vertical soil and waste stack.
  5. Cleanouts shall not be located behind casework or cabinets.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall. Install high enough for escutcheon cover to clear baseboard.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
1. Position floor drains for easy access and maintenance.
  2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
  3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.
- G. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- H. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 7.
1. Install roof-drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
  2. Position roof drains for easy access and maintenance.
- I. Install deep-seal traps on all mechanical room floor drains and other waste outlets, where indicated on plans, or as required by Code.
- J. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
1. Exception: Fitting may be omitted if trap has trap-seal primer connection.

- K. Install solids interceptors with cleanout immediately downstream from interceptors that do not have integral cleanout on outlet. Install trap on interceptors that do not have integral trap and are connected to sanitary drainage and vent systems. Install interceptors accessible without modifications to casework.
- L. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- M. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.
- N. Install trap primer lines below slab on grade to pitch to drains. No joints shall be installed in trap primer lines below slab on grade. Trap primer lines below grade shall be wrapped and coated.
- O. Install oil interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

### 3.3 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 15155

## SECTION 15160 - STORM DRAINAGE PIPING

### 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 storm drainage piping inside the building:
  - 1. Pipe, tube, and fittings.
- B. Related Sections include the following:
  - 1. Division 15 Section "Drainage Piping Specialties."

#### 1.3 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.
- B. TPE: Thermoplastic elastomer.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working-pressure, unless otherwise indicated:
  - 1. Storm Drainage Piping: 10-foot head of water above the highest connection point in the system.

#### 1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Field quality-control inspection and test reports.

#### 1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

## 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 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

### 2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888, for above grade rainwater downspout, and overflow roof drain piping. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF.
  - 1. Manufacturers:
    - a. Charlotte Pipe
    - b. Tyler Pipe
    - c. AB&I
- B. Shielded Couplings: ASTM 1540 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
  - 1. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
    - a. Manufacturers:
      - 1) Clamp-All Corp. - Model 80
      - 2) Husky – SD-2000
      - 3) Tyler Pipe; Soil Pipe Div.
      - 4) Mifab

### 2.4 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
  - 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
    - a. Manufacturers:
      - 1) Cambridge Lee
      - 2) Howell Metal
      - 3) Cerro Flow Products

### 2.5 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
  - 1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Series PS 100 sewer and drain pipe.
- B. Manufacturers:



1. Charlotte Pipe
2. Sanderson
3. Silverline

### PART 3 - EXECUTION

#### 3.1 EXCAVATION AND BACKFILL

- A. Excavations shall be performed in strict accordance with latest OSHA regulations. Sheet piling, bracing, barricades and fencing shall be installed wherever necessary to avoid undue hazards to workmen or passersby.
- B. During excavation, material shall be piled at a distance from the banks of the excavation that will avoid overloading and will prevent slides and/or cave-ins. Water accumulating in excavations shall be removed by pumping. Unless otherwise indicated, excavation shall be by open cut except that short sections of a trench may be tunneled under sidewalks and curbs where pipe can be installed as specified and back-fill can be tamped. All trenches and pit excavations shall be shored and/or braced as required to prevent slides and/or cave-ins.
- C. The bottom of the trenches shall be graded to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length, except for the portions of the pipe sections where it is necessary to excavate for bell holes and the making of pipe joints. Bell holes and depressions for joints shall be dug after the trench bottom has been graded. Over-depths shall be backfilled as specified and with materials for backfilling as specified.

#### 3.2 BACKFILLING

- A. The trenches shall not be backfilled until all required pressure and/or leak tests on piping are performed and until the mechanical systems as installed conform to requirements specified in the several sections covering the installation of the various systems. Trenches shall be backfilled to the ground surface with clean, selected excavated material or other material that meets compaction requirements and as hereinafter specified. Pavement and base course disturbed by trenching operation shall be restored to its original condition.
- B. Backfill material shall be deposited in 6-inch thick layers and compacted with mechanical tamps to the density of the adjacent soil or grade until there is a cover of not less than 2 feet over pipes. The backfill material in this portion of the trench shall consist of earth, sandy clay, soft shale, or other materials free from objects larger than 1 inch in any direction.
- C. The remainder of the trench shall be backfilled with clean, select material that is free of stones larger than 3 inches in any direction. Backfill material shall be deposited in layers not exceeding 6 inches thick, and each layer shall be compacted mechanically. Settling of granular, non-cohesive material with water will be permitted. The surface shall be mounded over for settling and left in a uniform condition.

#### 3.3 COMPACTION AND TESTING

- A. Areas under building locations, paving, walks or other structures which may be placed on site at a future date shall be compacted to 95% minimum dry proctor.

### 3.4 PIPING APPLICATIONS

- A. Underground, storm drainage piping for condensate drains outside of building pad shall be the following:
  - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- B. Aboveground, storm roof drain and overflow roof drain piping 12" and smaller inside the building shall be the following:
  - 1. Hubless cast-iron soil pipe and fittings heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
- C. Underground, storm drainage piping inside of building pad shall be the following:
  - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

### 3.5 PIPING INSTALLATION

- A. Storm sewer and drainage piping outside the building are specified in Division 2 Section "Storm Drainage."
- B. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- C. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 15 Section "Drainage Piping Specialties."
- D. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- E. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- F. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
  - 1. Building Storm Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.
- G. Install PVC storm drainage piping according to ASTM D 2665.
- H. Install underground PVC storm drainage piping according to ASTM D 2321.
- I. Do not enclose, cover, or put piping into operation until it is tested, inspected and approved by authorities having jurisdiction.
- J. Coordinate the stub up location of the exterior downspout boots and downstream piping on building exterior with architectural plans and elevations.
- K. No horizontal piping shall be installed in the slab.

3.6 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- B. PVC Non-pressure Piping Joints: Join piping according to ASTM D 2665.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect storm drainage piping to exterior aluminum downspouts and storm drainage specialties.

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and testing has been completed.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3.9 PIPING IDENTIFICATION

- A. All underground storm/downspout piping installed outside the building pad shall have continuous warning identification tape installed 12" above the top of the pipe and a minimum of 6" below finished grade.
- B. All underground PVC piping shall have a continuous tracer wire installed on the top of the pipe and attached with cable ties on 6' centers maximum spacing and within 12" from tees, branch connections and manufactured elbows.

3.10 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 15160

## SECTION 15194 - FUEL GAS PIPING

### 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 fuel gas piping within the building and outside the building. Products include the following:
  - 1. Pipe, tube, fittings, and joining materials.
  - 2. Piping specialties.
  - 3. Pressure regulators.
- B. Related Sections include the following:
  - 1. Section 15050 "Basic Mechanical Materials and Methods" for common products, installation accessories, and submittal requirements.
  - 2. Section 15060 Hangers and Supports" for pipe supporting and hanger spacing requirements for gas piping.
  - 3. Section 15075 "Mechanical Identification" for piping identification.
  - 4. Section 15110 "Plumbing Valves" for valve types and installation requirements.

#### 1.3 PROJECT CONDITIONS

- A. Gas System Pressures: Two pressure ranges. Primary pressure is 2.0 psig and is reduced to secondary pressure of 0.5 psig or less.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Pipe and pipe fittings. Include manufacturers product data.
  - 2. Pressure regulators. Include pressure rating, capacity, and settings of selected models complete with spring color and orifice sizes for each regulator.
- B. Welding Certificates.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For natural gas specialties and accessories to include in emergency, operation, and maintenance manuals to include parts breakdown.

#### 1.5 QUALITY ASSURANCE

- A. NFPA Standard: Comply with NFPA 54, "National Fuel Gas Code."

- B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and legally dispose of liquids from drips in existing gas piping. Handle cautiously to avoid spillage and ignition. Notify fuel gas supplier. Handle flammable liquids used by Installer with proper precautions and do not leave on premises from end of one day to beginning of next day.

#### 1.7 COORDINATION

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Architect's written permission.
- B. New Equipment: If gas fired equipment purchased is not basis of design equipment, the Contractor shall coordinate differences in gas demand and adjust pipe sizing and capacity requirements for gas pressure regulators based on equipment purchased at no cost increase to the Owner.

### 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 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

#### 2.3 STEEL PIPES, TUBES, FITTINGS, AND JOINING MATERIALS

- A. Domestic Steel Pipe: ASTM A 53/A 53M; Type E or S; Grade B; black. Wall thickness of wrought-steel pipe shall comply with ASME B36.10M.
  - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
  - 2. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.
  - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.
  - 4. Cast-Iron Flanges and Flanged Fittings: ASME B16.1, Class 125.
  - 5. Joint Compound and Tape: Suitable for natural gas.
  - 6. Steel Flanges and Flanged Fittings: ASME B16.5.
  - 7. Gasket Material: Thickness, material, and type suitable for natural gas.

B. Acceptable Manufacturers:

1. Pipe:
  - a. Wheatland
  - b. Sharon Tube
  - c. Allied
2. Fittings:
  - a. Ward
  - b. Anvil
  - c. Stockham

2.4 POLYETHYLENE PIPE, FITTINGS, AND JOINING MATERIALS

A. PE Pipe: For underground exterior use only. ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket type or ASTM D 3261, butt type with dimensions matching ASTM D 2513, SDR 11, PE pipe.
2. Transition Fittings: Manufactured pipe fitting with one PE pipe end for heat-fusion connection to PE pipe and with one ASTM A 53/A 53M, Schedule 40, steel pipe end for threaded connection to steel pipe.
3. Service-Line Risers: Manufactured PE pipe fitting with PE pipe inlet for heat-fusion connection to underground PE pipe; PE pipe riser section with protective-coated, anodeless, steel casing and threaded outlet for threaded connection to aboveground steel piping.
4. Components, Tapes, Gaskets, and Bolts and Nuts: Suitable for natural gas and as recommended by piping manufacturer.

B. Acceptable Manufacturers:

1. Pipe and fittings:
  - a. JM Eagle; UAC 2000
  - b. Duraline; Polytough1
  - c. Endot Industries; PE-2406/2708
  - d. Driscoplex 6500 series pipe and fittings.

2.5 PIPING SPECIALTIES

A. Flexible Connectors: ANSI Z21.24, copper alloy.

2.6 PRESSURE REGULATORS

A. Description: Single stage and suitable for fuel gas service. Include steel jacket and corrosion-resistant components, elevation compensator, and atmospheric vent.

1. Manufacturers:
  - a. Line Pressure Regulators:
    - 1) American Meter Company.
    - 2) Fisher Controls International, Inc.; Division of Emerson.
    - 3) Sensus.
    - 4) Maxitrol Company.
2. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
3. NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
4. Line Pressure Regulators: ANSI Z21.80 with 2.0 psig inlet pressure rating.

B. Pressure Regulator Vents: Factory- or field-installed, corrosion-resistant screen in opening if not connected to vent piping. Install 90 elbow turned down or pipe full size to exterior where called for on plans.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine roughing-in for gas piping system to verify actual locations of piping connections before equipment installation.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Close equipment shutoff valves before turning off fuel gas to premises or section of piping. Perform leakage test as specified in "Field Quality Control" Article to determine that all equipment is turned off in affected piping section.

#### 3.3 PIPING APPLICATIONS

- A. Flanges, unions, transition, and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, unless otherwise indicated.
- B. Fuel Gas Piping, 2 psig or less:
  - 1. Above ground piping 2" and smaller: Schedule 40 black steel pipe with malleable-iron threaded fittings.
  - 2. Above ground piping 2-1/2" and larger: Schedule 40 black steel pipe with schedule 40 butt weld fittings.
  - 3. Below ground piping 2" and smaller: Schedule 40 black steel pipe with steel welding fittings, and welded joints or PE pipe with heat-fusion joints and connections.

#### 3.4 VALVE APPLICATIONS

- A. Appliance Shutoff Valves for Pressure 0.5 to 2 psig:
  - 1. Plug valves for exterior piping systems at grade, at meter, and at emergency generator set.
  - 2. Full port ball valves inside building and on roof.
- B. Piping Line Valves, NPS 4 and Smaller:
  - 1. Plug valves for exterior piping systems at grade, at meter, and at emergency generator set.
  - 2. Full port ball valves inside building and on roof.

#### 3.5 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."
  - 1. Above-Ceiling Locations: Gas piping may be installed in accessible spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums.
  - 2. In Partitions: Do not install concealed piping in solid partitions. Protect tubing from physical damage when installed inside partitions or hollow walls perpendicular to penetrated walls.
    - a. Exception: Tubing passing through partitions or walls.
  - 3. Prohibited Locations: Do not install gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    - a. Exception: Accessible above-ceiling space specified above.



- B. Drips and Sediment Traps: Install drips at points where condensate or debris may collect. Include outlets of service meters. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.
  - 1. Construct drips and sediment traps using threaded tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.
- C. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels, unless indicated to be exposed to view.
- D. Install fuel gas piping at uniform grade of 0.1 percent slope upward toward risers.
- E. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down. Concentric reducers may be used in vertical and at unit connections.
- F. Connect branch piping from top or side of horizontal piping.
- G. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.
- H. Install strainer on inlet of line pressure regulator to emergency gas generator unit.
- I. Install pressure gauge test port upstream and downstream from each line pressure regulator.
- J. Install flanges on valves, specialties, and equipment having NPS 2-1/2 and larger connections.
- K. Install vent piping for gas pressure regulators and gas trains where called for on plans, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screen in large end.
- L. All steel gas piping below grade shall be wrapped and coated with cold tar epoxy coating.
- M. Install identification tag or stencil at each gas pressure regulator to match schedule on Contract Documents.
- N. Install underground, natural gas distribution piping buried at least 30 inches below finished grade.
- O. Install underground, PE, natural gas distribution piping according to ASTM D 2774.
- P. Install continuous # 12 copper tracer wire attached to the crown of buried PE exterior gas piping with plastic tie straps at maximum 6 foot spacing and within 18 inches of each change of direction. Tracer wire shall extend 6" above finished grade with one complete wrap around pipe on both ends at grade.
- Q. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tape 12 inches over the top of natural gas distribution piping during backfilling of trenches for piping.
- R. Exterior steel gas piping and fittings shall be prime painted at the time of installation. Final painting shall be performed after the system is tested for leaks and prior to system to being placed in service.

### 3.6 JOINT CONSTRUCTION

- A. Basic piping joint construction is specified in Division 15 Section "Basic Mechanical Materials and Methods."

- B. Use materials suitable for fuel gas.
- C. Patch factory-applied protective coating as recommended by manufacturer at field welds where damage to coating occurs during construction prior to final wrap and coating of piping.

### 3.7 CONNECTIONS

- A. Drawings indicate general arrangement of fuel gas piping, fittings, and specialties.
- B. Install piping adjacent to appliances to allow service and maintenance.
- C. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 72 inches of each appliance. Install union downstream from valve.
- D. Sediment Traps: Install tee fitting with minimum 3" long capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.
- E. Ground equipment according to Division 16 Section "Grounding and Bonding" Do not use gas piping as grounding electrode.

### 3.8 PIPING IDENTIFICATION

- A. All gas piping within the building shall be identified with pipe identification labels as specified in Division 15 Section "Mechanical Identification".
  - 1. Where piping is to be primed and painted, pipe identification shall be applied after the painting is completed.

### 3.9 PAINTING

- A. Use materials and procedures in Division 9 painting Sections.
- B. Priming of piping shall be performed at the time of installation. Final painting shall be done after the system has been tested, is free of leaks, and prior to system being placed in service.
- C. Paint exterior service meters, pressure regulators, and specialty valves.
  - 1. Color: Gray.
- D. Paint exterior piping downstream of meter, at generator set, and piping on roof.
  - 1. Color: Yellow.

### 3.10 FIELD QUALITY CONTROL

- A. Test, inspect, and purge piping according to NFPA 54 and requirements of authorities having jurisdiction.
- B. The Architect shall be given 48 hours notice for all scheduled inspections and testing for gas piping system installations.
- C. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.
- D. Verify capacities and pressure ratings of service meters, pressure regulators, valves, and specialties.

- E. Verify correct pressure settings for pressure regulators.
- F. Verify that specified piping tests are complete.

END OF SECTION 15194

## SECTION 15410 - PLUMBING FIXTURES

### 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 conventional plumbing fixtures and related components. Refer to "Plumbing Fixture Schedule" found at the end of this section for basis of design fixtures and model numbers.
  - 1. Faucets for lavatories and sinks.
  - 2. Flushometers.
  - 3. Toilet seats.
  - 4. Protective shielding guards.
  - 5. Fixture supports.
  - 6. Water closets.
  - 7. Urinals.
  - 8. Lavatories.
  - 9. Mop receptor basins.
  - 10. Mop receptor faucets.
- B. Related Sections include the following:
  - 1. Division 2 Section "Water Distribution" for exterior plumbing fixtures and hydrants.
  - 2. Division 10 Section "Toilet and Bath Accessories."
  - 3. Division 15 Section "Drinking Fountains and Water Coolers."
  - 4. Division 15 Section "Domestic Water Piping Specialties" for backflow preventers and specialty fixtures not included in this Section.
  - 5. Division 15 Section "Drainage Piping Specialties" for floor drains, cleanouts and other indirect waste specialties.

#### 1.3 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, drains, tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.
- C. Warranty: Special warranty specified in this Section.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
  - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Regulatory Requirements: Comply with requirements in the Georgia Accessibility Code for plumbing fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
  - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
  - 2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
  - 3. Stainless-Steel Residential Sinks: ASME A112.19.3.
  - 4. Vitreous-China Fixtures: ASME A112.19.2M.
- G. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
  - 1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
  - 2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
  - 3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
  - 4. Faucets: ASME A112.18.1.
  - 5. Hose-Connection Vacuum Breakers: ASSE 1011.
  - 6. Hose-Coupling Threads: ASME B1.20.7.
  - 7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
  - 8. NSF Potable-Water Materials: NSF 61.
  - 9. Pipe Threads: ASME B1.20.1.
  - 10. Supply Fittings: ASME A112.18.1.
  - 11. Brass Waste Fittings: ASME A112.18.2.
- H. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
  - 1. Atmospheric Vacuum Breakers: ASSE 1001.
  - 2. Brass and Copper Supplies: ASME A112.18.1.
  - 3. Dishwasher Air-Gap Fittings: ASSE 1021.
  - 4. Manual-Operation Flushometers: ASSE 1037.
  - 5. Plastic Tubular Fittings: ASTM F 409.
  - 6. Brass Waste Fittings: ASME A112.18.2.
- I. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  - 1. Dishwasher Air-Gap Fittings: ASSE 1021.
  - 2. Flexible Water Connectors: ASME A112.18.6.
  - 3. Floor Drains: ASME A112.6.3.
  - 4. Grab Bars: ASTM F 446.
  - 5. Hose-Coupling Threads: ASME B1.20.7.
  - 6. Off-Floor Fixture Supports: ASME A112.6.1M.
  - 7. Pipe Threads: ASME B1.20.1.
  - 8. Plastic Toilet Seats: ANSI Z124.5.
  - 9. Supply and Drain Protective Shielding Guards: ICC A117.1.

## 1.6 WARRANTY

- A. All fixtures and accessories shall be warranted against defects in materials and workmanship for a period of one year from date of acceptance by the Owner.

## 1.7 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. Urinal replacement cartridges: Furnish number of replacement cartridges equal to the number of fixtures installed at Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 LAVATORY FAUCETS

- A. Lavatory Faucets: P301H:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. T & S Brass and Bronze Works, Inc. B-2711-VF05 (Basis of Design)
    - b. Chicago Faucets.
    - c. Speakman Company.
    - d. Zurn Plumbing Products Group; Commercial Brass Operation.
    - e. American Standard
    - f. Delta
  - 2. Description: Single-control mixing valve with brass stems and ½" threaded inlet shanks. Provide .5 gpm flow limiting aerators. Include hot and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor. Connect cold water to both inlet shanks where only cold water is called for on plans.

### 2.2 FLUSHOMETERS

- A. Flushometers, P101, P101H, P102H:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Sloan
    - b. American Standard
    - c. Kohler
    - d. Zurn Plumbing Products Group; Commercial Brass Operation.
  - 2. Description: Manual flushometer for water-closet-type fixtures. Include brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, copper or brass tubing, polished chrome-plated finish on exposed parts and solid ring pipe support to wall for water closets. Provide ADA handle on accessible fixtures.
  - 3. Provide solid ring supports on water closet flush valves. Solid ring supports are not required on urinal flush valves.
  - 4. Basis of design – water closet flush valve; Sloan Royal 111-1.28
  - 5. Basis of design – urinal flush valve; G2 Royal 186-0.5
  - 6. Flush valves for water closets shall be 1.28 gpf.
  - 7. Flush valves for urinals shall be 0.5 gpf.
  - 8. Coordinate installation of flushometer rough-in with grab bars in handicap stalls.

### 2.3 TOILET SEATS

- A. Toilet Seats, P101, P101H, P102H:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Bemis Manufacturing Company. 1955 SSCT
  - b. Church Seats. 295 SSCT
  - c. Olsonite Corp. 10 SSCT
2. Description: Toilet seat for water-closet-type fixture.
  - a. Material: Molded, solid plastic.
  - b. Configuration: Open front without cover.
  - c. Size: Elongated.
  - d. Hinge Type: SC, self-sustaining, check, with Sta-Tite commercial fastening system.
  - e. Class: commercial.
  - f. Color: White.

#### 2.4 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers P301H:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. TRUEBRO, Inc. Model 103E-Z (Basis of Design)
    - b. McGuire Manufacturing Co., Inc.
    - c. Plumberex Specialty Products Inc.
    - d. Zurn Industries
  2. Description: Manufactured plastic wraps for covering plumbing fixture hot and/or cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

#### 2.5 FIXTURE SUPPORTS

- A. All wall hung lavatories, urinals and drinking fountains shall be supported independently of the wall by a commercial floor mounted carrier consisting of rectangular steel uprights with welded feet and secured to floor with lead anchor inserts or self drilling expansion shields and lag bolts at each location. Wall brackets and conceal arms shall be provided where appropriate for fixture being supported. Leveling and locking hardware shall be provided for lavatory carrier concealed arm supports.
- 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. Josam Company.
  2. MIFAB Manufacturing Inc.
  3. Smith, Jay R. Mfg. Co.
  4. Zurn Plumbing Products Group; Specification Drainage Operation.
  5. Watts Drainage
  6. Wade

#### 2.6 WATER CLOSETS

- A. Water Closets, P101, P101H, P102H:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Standard Companies, Inc.
    - b. Kohler Co.
    - c. Zurn
    - d. Sloan

2. Description: Accessible, floor-mounting, floor-outlet, white, elongated, 1.28 gpf vitreous-china fixture designed for flushometer valve operation, top spud with brass floor mounting hardware and bolt caps.
3. All water closet bowl gaskets between floor and waste pipe connection shall be a combination of wax seal with plastic or urethane reinforced flanged polyethylene sleeve permanently molded into gasket assembly.
  - a. Oatey Model No. 31194
  - b. Hercules Plumbing Products Johni-Ring Model No. 90-220
  - c. Plastic Oddities Inc. Model BG-7k.

## 2.7 URINALS

- A. Urinals, P201, P201H:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Standard Companies.
    - b. Zurn
    - c. Kohler Co.
    - d. Sloan
  2. Sloan Description: Accessible, wall-mounting, 2" back-outlet, vitreous-china fixture mounted on commercial floor carrier. 3/4" top spud, 1/8 gallon per flush.
  3. Urinal waste arms from fixture outlet to connection at stack shall be seamless brass with bronze/brass threaded fittings.

## 2.8 WALL HUNG LAVATORIES

- A. Lavatories, P301H:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Standard Companies, Inc.
    - b. Kohler Co.
    - c. Zurn
    - d. Sloan
  2. Description: Accessible, wall-mounting, white, vitreous-china fixture with 1 or 3-hole drilling, nominal 20" x 18" with backsplash and drilled for concealed arm supports and mounted on commercial floor carrier.

## 2.9 MOP RECEPTOR BASINS

- A. Mop Basins, P501:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Kohler "Whitby No. K-6710-0 (Basis of Design)
    - b. Acorn Engineering Company.
    - c. Crane Plumbing, L.L.C./Fiat Products.
    - d. Florestone Products Co., Inc.
    - e. Precast Terrazzo Enterprises, Inc.
    - f. Stern-Williams Co., Inc.
  2. Description: Flush-to-wall, floor-mounting, cast iron with rim guard. 28" x 28" with 12" high curbs all around. 3" drain outlet with grid strainer.

## 2.10 MOP RECEPTOR FAUCETS

- A. Mop Receptor Faucets: P501:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:



- a. Symmons
  - b. Speakman Company; SC-5812.
  - c. T & S Brass and Bronze Works, Inc.; B-0665-BSTP
  - d. Zurn Plumbing Products Group; Commercial Brass Operation; Z843M1-CS.
  - e. American Standard; 8344012.002
2. Description: Cast brass, polished chrome, wall mounted fitting with integral check stops, cast brass nozzle with 3/4" hose thread and pail hook, brass top brace with wall flange. 1/2" supplies with chrome wall flanges. Vandal resistant handles lever or four arm with color coded indexes. ASSE-1001 compliant.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed. Coordinate countertop heights with Architectural plans and elevations.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
  1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
  2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
  3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install counter-mounting fixtures in and attached to casework.
- G. Install fixtures level and plumb according to roughing-in drawings.
- H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
  1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 15 Section "Plumbing Valves."
- I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system. Cleanout plug in trap shall be accessible for removal of plug.
- J. Install flushometer valves for accessible water closets and rough in only (behind the wall) for urinals with handle mounted on wide side of compartment as applicable. Install other actuators in locations that are easy for people with disabilities to reach.

- K. Install toilet seats on water closets.
- L. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves. Faucet assemblies shall be set square to sinks and lavatories, with paired faucet handles set symmetrical in the off position.
- M. Install traps on fixture outlets.
  - 1. Exception: Omit trap on fixtures with integral traps.
  - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- N. Install dishwasher air-gap fitting at each sink indicated to have a dishwasher. Install on countertop at sink. Connect inlet hose to dishwasher and outlet hose to disposer where required.
- O. Install deep escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons to conceal protruding fittings. Escutcheons are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- P. Set mop receptor basins in leveling bed of cement grout. Grout is specified in Division 15 Section "Basic Mechanical Materials and Methods."
- Q. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 7 Section "Joint Sealants."
- R. Miscellaneous wall mounted items such as hose bibs, wash down fittings and flush valves shall have supplementary steel angles and a steel mounting plate securely attached to the wall framing to provide rigid support.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

### 3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

### 3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust controls. Replace damaged and malfunctioning units and controls.
- C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

D. Replace washers, cartridges and/or seals of leaking and dripping faucets and stops.

E. Adjust faucet valve temperature limit stops to 105 F maximum.

### 3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.
3. Clean all floor drain grate tops and floor cleanout covers to like new condition.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

### 3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 15410 (EXCEPT FOR THE ATTACHED PLUMBING FIXTURE SCHEDULE)

### PLUMBING FIXTURE SCHEDULE

P101 Water Closet - Floor Mounted – Handicap - Kohler “Juvenile Ultra” No. K-96059, white vitreous china toilet, elongated siphon jet action bowl, two bolt caps, manual flush valve with solid ring stanchion secured to wall, white solid plastic open front heavy-duty seat.

P101H Water Closet - Floor Mounted – Handicap - Kohler “Juvenile Ultra” No. K-96059, white vitreous china toilet, elongated siphon jet action bowl, two bolt caps, manual flush valve with solid ring stanchion secured to wall, white solid plastic open front heavy-duty seat.

P102H Water Closet - Floor Mounted – Handicap - Kohler “Highcliff Ultra” No. K-96057, white vitreous china toilet, elongated siphon jet action bowl, two bolt caps, manual flush valve with solid ring stanchion secured to wall, white solid plastic open front heavy-duty seat.

P201 Urinal - Wall Hung – 0.5 GPF – Kohler “Bardon” No. K-4991-ET-0, white vitreous china, siphon jet action with 3/4" top spud, 2" I.P.S. outlet, and manual flush valve, 3/4" spud, wall and spud flanges. Provide concealed floor mounted carrier, mount rim at 15" above finished floor.

P201H Urinal - Wall Hung – 0.5 GPF – Handicap - Kohler “Bardon” No. K-4991-ET-0, white vitreous china, siphon jet action with 3/4" top spud, 2" I.P.S. outlet, and manual flush valve, 3/4" spud, wall and spud flanges. Provide concealed floor mounted carrier, mount rim at 17" above finished floor.

P301H Lavatory - Wall Hung - Kohler “Greenwich” No. K-2031 white vitreous china lavatory, single drilling, with concealed overflow, faucet with .5 gpm aerator, McGuire Model No. 155WC offset grid drain assembly, McGuire No. 8872C-DF 1-1/4" chrome plated P-Trap with brass nuts, cleanout plug and deep wall escutcheon, McGuire No. LFH170LK chrome plated copper tube supplies with angle stops, loose tee keys, and deep wall escutcheons. Provide floor mounted carrier with concealed arms and mount with a clearance of 34" measured from the finished floor to the top of rim. Provide handicapped covers on offset drain, p'trap and both supplies.

P501 Mop Receptor and Faucet – 28"x28" cast iron, porcelain enamel, floor mounted corner receptor with rim guard and faucet with hose. Mount faucet 48" AFF.

A New Classroom Addition for:  
Davis Elementary School

SECTION 15410  
Plumbing Fixtures

END OF SECTION 15410

## SECTION 15415 - DRINKING FOUNTAINS & WATER COOLERS

### 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 related components:
  - 1. Drinking Fountains
  - 2. Bottle Filling Stations
  - 3. Fixture supports.

#### 1.3 DEFINITIONS

- A. Accessible Drinking Fountain: Fixture that can be approached and used by people with disabilities.
- B. Drinking Fountain: Fixture with nozzle for delivering stream of water for drinking.
- C. Fitting: Device that controls flow of water into or out of fixture.
- D. Fixture: Drinking fountain or water cooler unless one is specifically indicated.

#### 1.4 SUBMITTALS

- A. Product Data: For each fixture indicated. Include rated capacities, furnished specialties, and accessories.
- B. Operation and Maintenance Data: For fixtures to include in emergency, operation, and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" Public Law 101-336, "Americans with Disabilities Act"; for fixtures for people with disabilities.
- B. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- C. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.

#### 1.6 WARRANTY

- A. The complete water cooler and packaged water chiller unit inclusive of compressor, hermetically sealed refrigeration unit, water system, water regulator and electrical components shall be warranted be free from defects in material and workmanship for (1) year from the date of installation. Contractor shall submit the warranty data sheet to the Architect within 3 days of completed installation for record.

## PART 2 - PRODUCTS

### 2.1 WATER COOLERS

- A. Water coolers, P401H:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Elkay Model No. VRC8S or a comparable vandal resistant product by one of the following:
    - a. Oasis Manufacturing Co.
    - b. Halsey Taylor.
    - c. Acorn Aqua.
  - 2. Description: Accessible, Style W, wall-mounting drinking fountain.
    - a. Material: Stainless steel top, stainless steel cabinet finish.
    - b. Receptor Shape: Rectangular.
    - c. Bubblers: One, vandal resistant, with adjustable stream regulator, located on deck.
    - d. Control: Push button.
    - e. Supply: NPS 3/8, stop valve with isolation ball valve above ceiling.
    - f. Drain: Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.2.
    - g. Support: Type I, water cooler carrier. Refer to "Fixture Supports" Article.

### 2.2 BOTTLE FILLING STATIONS

- A. Bottle Filling Stations, P401B:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Elkay Model No. EZS8WSVRSK or a comparable vandal resistant product by one of the following:
    - a. Oasis Manufacturing Co.
    - b. Halsey Taylor.
  - 2. Description: Accessible, Style W, wall-mounting water cooler.
    - a. Material: Stainless steel top, stainless steel cabinet finish.
    - b. Receptor Shape: Rectangular.
    - c. Bubblers: One, vandal resistant, with adjustable stream regulator, located on deck.
    - d. Control: Push button.
    - e. Bottle filler: Electronic sensor, no touch activation, automatic 20 second shutoff timer.
    - f. Supply: NPS 3/8, stop valve with isolation ball valve above ceiling.
    - g. Drain: Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.2.
    - h. Support: Type I, water cooler carrier. Refer to "Fixture Supports" Article.

### 2.3 FIXTURE SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Josam Co.
  - 2. MIFAB Manufacturing, Inc.
  - 3. Smith, Jay R. Mfg. Co.
  - 4. Zurn Plumbing Products Group; Specification Drainage Operation.
  - 5. Watts Drainage.
- B. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.
  - 1. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.
- B. Examine walls and floors for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLICATIONS

- A. Use floor mounted carrier supports for wall-mounting fixtures, unless otherwise indicated.
- B. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

### 3.3 INSTALLATION

- A. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- B. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 15 Section "Plumbing Valves."
- C. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- D. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- E. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 7 Section "Joint Sealants."
- F. Fixtures shall be supported at bottom with toggle bolts thru wall.

### 3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

### 3.5 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.

### 3.6 CLEANING

- A. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 15415 (EXCEPT FOR THE ATTACHED PLUMBING FIXTURE SCHEDULE)

PLUMBING FIXTURE SCHEDULE

- P401H Electric Water Cooler - Wall Hung - Handicapped - Elkay Model No. VRC8S minimum capacity of 8.0 gph of 50 degree water at A.R.I. standard conditions, with wall hanger push button control, 1-1/4", 17 gauge chrome plated tailpiece, McGuire No. H170LK angle stop and supply with deep wall escutcheon, McGuire No. 8872C-DF 1-1/4" 17 gauge chrome plated P-Trap with brass nuts, cleanout plug and deep wall escutcheon. Provide floor mounted concealed carrier and mount fixture with spout outlet at 36" above finished floor.
- P401B Electric Water Cooler - Wall Hung - Handicapped – Bottle Filling Station - Elkay VRCGRN8WSK vandal resistant unit with a minimum capacity of 8.0 gph of 50 degree water at A.R.I. standard conditions, bottle filling station, with wall hanger, vandal resistant push button control, 1-1/4" tailpiece, McGuire No. 2158LK angle stop and supply with deep escutcheon, McGuire No. 8872C-DF 1-1/4" p-trap with brass nuts, cleanout plug and deep wall escutcheon. Provide floor mounted concealed carrier and mount fixture with center of bubbler at 30" above finished floor.



## SECTION 15732 - ROOFTOP UNITS

### 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. Division 15 Section "HVAC Instrumentation and Controls" for control wiring and control devices connected to energy recovery units.

#### 1.2 SUMMARY

- A. This Section includes the following rooftop air conditioners:
  - 1. Cooling and heating units 6 tons and smaller.
  - 2. Cooling and heating units 7-1/2 to 25 tons.

#### 1.3 DEFINITIONS

- A. BAS: Building automation system

#### 1.4 SUBMITTALS

- A. Product Data: Include manufacturer's technical data for each model indicated, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. Prepare the following by or under the supervision of a qualified professional engineer:
  - 1. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
  - 2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
  - 3. Wiring Diagrams: Power, signal, and control wiring.
- C. Operation and Maintenance Data: For rooftop air conditioners to include in emergency, operation, and maintenance manuals.
- D. Warranties: Special warranties specified in this Section.

#### 1.5 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of rooftop air conditioners and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- 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. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
- D. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- E. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- F. Comply with NFPA 54 for gas-fired furnace section.
- G. ARI Certification: Units shall be ARI certified and listed.
- H. ARI Compliance for Units with Capacities Less Than 135,000 Btuh : Rate rooftop air-conditioner capacity according to ARI 210/240, "Unitary Air-Conditioning and Air-Source Heat Pump Equipment."
  - 1. Sound Power Level Ratings: Comply with ARI 270, "Sound Rating of Outdoor Unitary Equipment."
- I. ARI Compliance for Units with Capacities 135,000 Btuh and More: Rate rooftop air-conditioner capacity according to ARI 340/360, "Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment."
  - 1. Sound Power Level Ratings: Comply with ARI 270, "Sound Rating of Outdoor Unitary Equipment."

#### 1.6 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."
- C. Coordinate size, location, and installation of rooftop air-conditioner manufacturer's roof curbs and equipment supports with roof installer.
- D. Coordinate installation of restrained vibration isolation roof-curb rails.
- E. Duct mounted smoked shall be installed to be accessible from an 8 foot ladder except for in the Gymnasium and Cafeteria.

#### 1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of rooftop air conditioners that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Final Completion.
  - 2. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from date of Final Completion.
  - 3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Final Completion.

4. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Final Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### 2.2 ROOFTOP AIR CONDITIONERS

- A. Manufacturers:
  1. Trane – High Efficiency Model
  2. Carrier - High Efficiency Model
  3. Daikin - High Efficiency Model
- B. Furnish and install factory assembled, piped and wired single package air conditioners of the type, size operational characteristics and capacity as shown and scheduled on the plans and as specified herein. Unit shall have electric heat section. **All units 5 tons and larger shall be equipped with an economizer cycle. All units regardless of size shall be provided with a dehumidification cycle.**
- C. Casings:
  1. Unit shall be designed specifically for outdoor installation. All components including accessories shall be contained within the unit.
  2. Unit shall be insulated with a minimum of one inch, one pound density glass fiber insulation.
  3. Provide units with hail guard covers over the condenser coils.
- D. Compressor:
  1. Hermetic or semi-hermetic reciprocating compressors shall be provided with capacity reduction of a minimum of two steps.
  2. A crankcase heater shall be provided and wired to be active continuously.
  3. The compressors shall be provided with vibration isolators.
  4. Self-reversing oil pump shall provide positive lubrication regardless of rotation.
  5. Compressor shall receive a run-in test at the factory prior to installation into the rooftop units.
  6. Each compressor shall have a warranty covering parts failure for a period of five years.
- E. Refrigerant circuit:
  1. Coils shall be constructed of copper tubes mechanically bonded to aluminum fins. It shall be tested for leaks at 300 psig pressure prior to installation within the unit. Expansion valve and filter drier shall be factory installed.
  2. The evaporator coil shall consist of separate refrigerant circuits with individual thermal expansion valves. Provide liquid line sight glasses and filter dryers. Each circuit shall have separate refrigerant controls.
  3. Refrigeration controls shall include a minimum high and low pressure control, compressor winding thermostat and overload, lockout circuit resettable at the unit

- thermostat, contactors for condenser/evaporator fans and compressor, and control power transformer.
4. Condenser fans shall be direct driven propeller type using three phase motors.
- F. Electric Heat:
1. General: Corrosion resistant steel sheathed elements mechanically bonded to corrosion resistant steel fins. Elements shall be helically coiled nickel chromium alloy resistance wire embedded in and surrounded by magnesium oxide. Heater shall have a minimum of two stages of heat.
  2. Safety Controls: Automatic limit and thermal cut-off safety
- G. Evaporator Fan: Evaporator fan shall be belt driven forward curved type with an adjustable sheave and motor sized to meet the air flow and static pressure as scheduled on the drawings. Motor shall have thermal overload protection and motor and fan bearings shall be permanently lubricated.
- H. Filters: Two sets of 2", 35% efficient, pleated throwaway filters shall be provided with the units.
- I. Refrigerant shall be R-410a.
- J. Accessories to be provided:
1. Factory furnished and wired firestats. Return air firestats shall be set at 135 degrees and supply air firestats at 245 degrees wired so as to shut down the supply air fan if a fire exists. Firestats shall be of the manual reset type.
  2. Low ambient operation kit (25 degrees F).
  3. Fully automatic economizer cycle for units 3 tons and larger including factory installed controls with moisture eliminators and minimum position rheostat including dampers with modulating controllers and spring return operators. Provide barometric relief including exhaust dampers and exhaust hood. Coordinate economizer interface with the BAS for control.
  4. All rooftop units shall be furnished with an internal factory mounted 120 Volt convenience outlet, internally wired through the roof curb assembly. Outlet shall be powered separately from the rooftop unit to allow continued operation when the unit disconnect is off.
  5. Units shall contain an integral de-humidification cycle with hot gas reheat coil as indicated in equipment schedule.
  6. Units shall be provided with dehumidification cycle, which consist of hot gas reheat coil. All associated wiring, tubing, and valves shall be provided and factory installed. Refer to rooftop unit schedule for units requiring dehumidification cycle.
  7. Provide power entrance for power routed from pipe portal on roof.
  8. Provide units with hail guard covers over the condenser coils.
  9. Provide units with hinged access doors.

## 2.3 ROOF MOUNTING CURBS

- A. Provide a pre-fabricated, insulated, 12 gauge galvanized steel roof mounting curb for all roof mounted equipment. Duct support members shall be provided to allow for pre-hanging of ductwork prior to unit installation. Provide gasketing to form a positive, weather tight seal between the curb and unit base. Design shall comply with all requirements of the National Roofing Contractors Association. Base of curb shall conform to roof slope and provide a level base on which to mount equipment. Curb overall height (from roof structure to top of curb)

shall provide a min. 10" clearance between the top of the curb and the finished roof surface or the minimum height required to meet the roofing bond specifications, whichever is greater.

- B. Insulation shall be 1-1/2 inch thick, 3-lb. density rigid type. Nailer shall be constructed of pressure treated wood.
- C. All roof mounting curbs shall comply with requirements of architectural division of the specifications. All roof curbs shall be approved by the Architect prior to placing order for construction.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install unit level and plumb, maintaining manufacturer's recommended clearances.
- B. Curb Support: Install and secure rooftop air conditioners on curbs and coordinate roof penetrations and flashing with roof construction. Secure units to curb support with anchor bolts.

#### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Controls shall be interfaced and connected per 15900 HVAC Instrumentation and Controls. Unit shall interface with ALC's provided controls.
- C. Duct installation requirements are specified in other Division 15 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
  - 1. Install ducts to termination in roof curb.
  - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
  - 3. Connect supply ducts to rooftop unit with flexible duct connectors specified in Division 15 Section "Duct Accessories."
  - 4. Terminate return-air duct through roof structure and insulate space between roof and bottom of unit with 2-inch- thick, acoustic duct liner.
- D. Electrical System Connections: Comply with applicable requirements in Division 16 Sections for power wiring, switches, and motor controls.
- E. Ground equipment according to Division 16 Section "Grounding and Bonding."
- F. 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.
- G. Coordinate power connection for the convenience outlet with the electrical division of work.

#### 3.3 STARTUP SERVICE

- A. Engage a factory-employed service representative to perform startup service.

- B. Complete installation and startup checks according to manufacturer's written instructions and do the following:
1. Inspect for visible damage to unit casing.
  2. Inspect for visible damage to electric heater.
  3. Inspect for visible damage to compressor, air-cooled outside coil, and fans.
  4. Inspect internal insulation.
  5. Verify that labels are clearly visible.
  6. Verify that clearances have been provided for servicing.
  7. Verify that controls are connected and operable.
  8. Verify that filters are installed.
  9. Clean outside coil and inspect for construction debris.
  10. Clean furnace flue and inspect for construction debris.
  11. Adjust vibration isolators.
  12. Inspect operation of barometric dampers.
  13. Lubricate bearings on fan.
  14. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
  15. Adjust fan belts to proper alignment and tension.
  16. Start unit according to manufacturer's written instructions.
  17. Start refrigeration system in summer only.
  18. Complete startup sheets and attach copy with Contractor's startup report.
  19. Inspect and record performance of interlocks and protective devices; verify sequences.
  20. Operate unit for an initial period as recommended or required by manufacturer.
  21. Inspect outside-air dampers for proper stroke and interlock with return-air dampers.
  22. Start refrigeration system and measure and record the following:
    23. Coil leaving-air, dry- and wet-bulb temperatures.
    24. Coil entering-air, dry- and wet-bulb temperatures.
  25. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
  26. After startup and performance testing, change filters, vacuum heat exchanger and cooling and outside coils, lubricate bearings, adjust belt tension, and inspect operation of power vents.

### 3.4 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

### 3.5 FIELD QUALITY CONTROL

- A. During construction unit filters shall be periodically changed while the unit is in operation. This shall include unit filter as well as a filter media to be placed over the return grilles. The unit filter and filter media shall be dated at each replacement. If the ductwork or evaporator coil becomes dirty, the contractor shall clean the ductwork and coil. The contractor shall provide the owner a letter stating that all coils have been inspected and are clean at Substantial Completion.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rooftop air conditioners. Refer to Division 1 Section "Demonstration and Training".

3.7 SYSTEM ACCEPTANCE

- A. Reference section 01770 for general requirements.

3.8 CLOSEOUT DOCUMENTATION

- A. Properly completed start-up forms, including equipment marks and serial numbers, documenting proper start-up service, adjusting, and demonstration shall be received by the Owner prior to granting of substantial completion.

END OF SECTION 15732

## **SECTION 15738 - SPLIT-SYSTEM AIR-CONDITIONING UNITS**

### **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 split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

#### **1.3 SUBMITTALS**

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Field quality-control test reports.
- C. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.
- D. Warranty: Special warranty specified in this Section.

#### **1.4 QUALITY ASSURANCE**

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- 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. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- D. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."



## 1.5 COORDINATION

- A. Coordinate size and location of concrete bases for units. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete."
- B. Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations specified in Division 7 Section "Roof Accessories."

## 1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Final Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Carrier Air Conditioning; Div. of Carrier Corporation.
  - 2. Mitsubishi Heavy Industries America, Inc.; Air-Conditioning & Refrigeration Division, Inc.
  - 3. Daikin

### 2.2 DUCTLESS SPLIT SYSTEM OUTDOOR UNIT

- A. Unit shall be an air-to-air electric condensing unit for use in conjunction with a exposed ductless, direct expansion fan coil. Schedule capacities are minimum.
- B. Outdoor unit shall contain a hermetic compressor with overload protection. Compressor shall be provided with an extended five-year warranty.
- C. Outdoor fans shall be direct motor driven propeller type, horizontal discharged, and statically and dynamically balanced.
- D. Condenser coil shall be aluminum fin type mechanically bonded to non-ferrous tubing, pressure tested and protected from external damage by grilles.
- E. Outdoor condensing unit shall be capable of operation down to 0 degrees F. outdoor temperature, and be complete with head pressure control, recycling timer, filter/dryer, refrigerant sight glass, liquid line solenoid valve, and service valves.
- F. Unit shall contain refrigerant expansion valve for noise reduction.

- G. Unit shall be mounted securely on equipment pad or roof supports, in a manner to allow servicing and provide adequate drainage during defrost cycles. Refrigerant piping shall be sized per the manufacturer's requirement. Refrigerant piping shall be ACR. Line sets are not acceptable. Mounting Base: Polyethylene.
- H. Unit shall be installed in strict accordance with manufacturers recommendations.

## 2.3 DUCTLESS SPLIT SYSTEM INDOOR FAN COIL

- A. Unit shall be ceiling mounted cassette ductless type fan-coil with integral four way discharge double deflection grilles, internal condensate pump, wall mounted controls, and easy to remove filters. Units shall be U.L. listed.
- B. Cabinet shall be constructed of 20 gage galvanized steel with baked enamel finish (color to be selected by Owner). Interior of cabinet shall be insulated with 1/4 inch thickness fiberglass insulation. cabinet shall include a galvanized steel condensate drain pan with anti-corrosion coating, die formed intake grille, permanent filter, and bi-directional discharge grille with airfoil louvers of anodized aluminum. Unit shall be supported from roof structure by min. of four (4) 1/2" threaded rods with neoprene vibration isolation kits.
- C. Evaporator blower shall consist of dual DWDI centrifugal type directly mounted to the motor shaft with assembly dynamically balanced. Motors shall be P.S.C. type with overload protection.
- D. Cooling coils shall be seamless copper tubing arranged in staggered configuration with aluminum fins mechanically bonded, tested to 460 psig.
- E. Fan coil unit shall be factory tested and include relays for connecting to outdoor unit, hanger brackets, disconnect switch and remote hard-wired thermostat.
- F. Unit shall be provided with an internal or external condensate pump as required by the installation lift height.

## 2.4 ACCESSORIES

- A. Wall mounted Thermostat: Low voltage with subbase to control compressor and evaporator fan. Wireless thermostats are not acceptable. Unit shall be interfaced with BAS for scheduling in occupied areas. Units for data areas shall be continuous run, with independent monitoring by the BAS.
- B. Automatic-reset timer to prevent rapid cycling of compressor.
- C. Refrigerant Piping: Refrigerant piping shall be ACR refer to section 15183 Refrigerant Piping.
- D. Field installed condensate pump. Sized for the specific installation.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install indoor and outdoor unit level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install ground-mounting, compressor-condenser components on 4-inch- thick, reinforced concrete base; 4 inches larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.
- D. Install roof-mounting compressor-condenser components on equipment supports specified in Division 7 Section "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners with neoprene washers.
- E. Install seismic restraints.
- F. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch. Refer to Division 15 Section "Mechanical Vibration Controls and Seismic Restraints."
- G. Condensate for indoor fan-coil unit shall be lifted by unit condensate pump and drain by gravity to building waste system. All piping shall be copper from unit to building drain.

#### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to unit to allow service and maintenance. All roof penetrations shall be through a pre-fabricated roof portal and curb.
- C. Duct Connections: Duct installation requirements are specified in Division 15 Section "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Division 15 Section "Duct Accessories."
- D. Ground equipment according to Division 16 Section "Grounding and Bonding."
- E. Electrical Connections: Comply with requirements in Division 16 Sections for power wiring, switches, and motor controls.
- F. Piping from condensate pump to the building waste system.

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 4. Remove and replace malfunctioning units and retest as specified above.
- B. During construction unit filters shall be periodically changed while the unit is in operation. This shall include unit filter as well as a filter media to be placed over the return grilles. The unit filter and filter media shall be dated at each replacement. If the ductwork or evaporator coil becomes dirty, the contractor shall clean the ductwork and coil. The contractor shall provide the owner a letter stating that all coils have been inspected and are clean at Substantial Completion.

### 3.4 STARTUP SERVICE

- A. Engage a factory-employed service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. Refer to Division 1 Section "Closeout Procedures Demonstration and Training."

### 3.6 SYSTEM ACCEPTANCE

- A. Reference section 01770 for general requirements.

### 3.7 CLOSEOUT DOCUMENTATION

- A. Properly completed start-up forms, including equipment marks and serial numbers, documenting proper field quality control, start-up service, and demonstration shall be received by the Owner prior to granting of substantial completion.

END OF SECTION 15738

## **SECTION 15765 - WALL & CEILING HEATERS**

### **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 wall and ceiling heaters with propeller fans and electric heating elements.

#### **1.3 SUBMITTALS**

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Plans, elevations, sections, and details.
  - 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Operation and Maintenance Data: For wall and ceiling heaters to include in emergency, operation, and maintenance manuals.

#### **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.

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURED UNITS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Raywall.
  - 2. Markel Products.
  - 3. QMark Electric Heating.

## 2.2 ELECTRIC CEILING MOUNTED HEATERS

- A. Provide heavy duty, ceiling mounted, forced air heater of the voltage as specified under the electrical division of work. Units shall be installed and wired in accordance with the manufacturer's recommendations and applicable national and local codes.
- B. Heater shall be lay-in ceiling design mounted in the horizontal position. Unit shall contain vertical down discharge designed to supply heated air at the floor with unit mounted at 10'-0" above floor.
- C. Fan motor shall be permanently lubricated, totally enclosed, shaded pole type with impedance protection. A protective shield shall surround the motor to separate return air from the supply air.
- D. Heating element assemblies shall consist of two or three corrosion resistant steel sheathed elements, mechanically bonded to common corrosion resistant steel fins. Elements shall be helically coiled nickel chromium alloy resistance wire completely embedded in and surrounded by magnesium oxide, enclosed and swaged into corrosion resistant steel sheaths. Elements shall have no more than 60 watts per inch.
- E. Heaters shall be equipped with a zero voltage reset thermal overload, which disconnects the motor and elements should normal operating temperatures be exceeded. Provide with manual reset.
- F. Provide integral tamper proof, low voltage thermostat for corridor installations. Provide wall mounted thermostats for storage room installations. All thermostats and heaters shall be capable of interface with building management system for scheduling.
- G. Units shall be U.L. listed with integral disconnect switch.

## 2.3 ELECTRIC WALL HEATERS

- A. Provide heavy duty, wall mounted, forced air heater of the voltage as specified under the electrical division of work. Units shall be installed and wired in accordance with the manufacturer's recommendations and applicable national and local codes.
- B. Heater shall be wall mounted in the vertical. Unit shall contain vertical down discharge designed to supply heated air at the floor.
- C. Fan motor shall be permanently lubricated, totally enclosed, shaded pole type with impedance protection. A protective shield shall surround the motor to separate return air from the supply air.
- D. Heating element assemblies shall consist of two or three corrosion resistant steel sheathed elements, mechanically bonded to common corrosion resistant steel fins. Elements shall be helically coiled nickel chromium alloy resistance wire completely embedded in and surrounded by magnesium oxide, enclosed and swaged into corrosion resistant steel sheaths. Elements shall have no more than 60 watts per inch.

- E. Heaters shall be equipped with a zero voltage reset thermal overload, which disconnects the motor and elements should normal operating temperatures be exceeded. Provide with manual reset.
- F. Provide with integral, tamper proof, low voltage thermostat.
- G. Units shall be U.L. listed with integral disconnect switch, and be manufactured by Markel, Raywall, or Berko.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas to receive wall and ceiling heaters for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for electrical connections to verify actual locations before wall and ceiling heater installation.

#### 3.2 INSTALLATION

- A. Install wall boxes in finished wall assembly.
- B. Install wall and ceiling heaters to comply with NFPA 90A.
- C. Suspend wall and ceiling heaters from structure with threaded rod.

#### 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 ADJUSTING

- A. Adjust initial temperature set points.

#### 3.5 STARTUP SERVICE

- A. See start up card in 15050 BASIC MECHANICAL MATERIALS & METHODS.
- B. Provide "off-season". Heating equipments shall be tested for operation. If heating equipment is initial tested during the summer, it must be retested during the winter.

END OF SECTION 15765

A New Classroom Addition for:  
Davis Elementary School

Section 15765  
Wall & Ceiling Heaters



## **SECTION 15815 - METAL DUCTS**

### **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 metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg. Metal ducts include the following:
  - 1. Rectangular ducts and fittings.
  - 2. Single-wall, round spiral-seam ducts and formed fittings.
  - 3. Duct liner.
  - 4. Flexible ducts
- B. Related Sections include the following:
  - 1. Division 15 Section "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, and turning vanes.

#### **1.3 DEFINITIONS**

- A. FRP: Fiberglass-reinforced plastic.
- B. NUSIG: National Uniform Seismic Installation Guidelines.

#### **1.4 SYSTEM DESCRIPTION**

- A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

#### **1.5 SUBMITTALS**

- A. Shop Drawings: CAD-generated and drawn to 1/4 inch equals 1 foot scale. Show fabrication and installation details for metal ducts.
  - 1. All ducts shown on the mechanical platform plan, all duct associated with rooftop units, and a detail of the typical corridor section showing all trades coordinated.
  - 2. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.

3. Duct layout indicating sizes and pressure classes.
4. Elevations of top and bottom of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Duct accessories, including access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, vibration isolation, and seismic restraints.

- B. Field quality-control test reports.

## 1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports and AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. NFPA Compliance:
1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
  2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- C. Comply with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations," Ch. 3, "Duct System," for range hood ducts, unless otherwise indicated.

## 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 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G60 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

- C. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, matte finish for exposed ducts.
- D. Stainless Steel: ASTM A 480/A 480M, Type 316, and having a No. 2D finish for concealed ducts and No. BA for exposed ducts.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## 2.3 DUCT LINER

- A. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124.
  - 1. Manufacturers:
    - a. CertainTeed Corp.; Insulation Group.
    - b. Johns Manville International, Inc.
    - c. Knauf Fiber Glass GmbH.
    - d. Owens Corning.
  - 2. Materials: ASTM C 1071; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers.
    - a. Thickness: 1 inch.
    - b. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.
    - c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
    - d. Noise Reduction Coefficient: Minimum 0.70 based on type "A" mounting per ASTM C423.
    - e. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
    - f. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.
      - 1) Tensile Strength: Indefinitely sustain a 50-lb- tensile, dead-load test perpendicular to duct wall.
      - 2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.
      - 3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

## 2.4 SEALANT MATERIALS

- A. Joint and Seam Sealants, General: Duct sealant used on interior duct locations shall be water-based, designed for interior installations. Duct sealant used on exterior duct locations shall be water-based and designed for exterior installations. Duct sealant shall be non-flammable, fiber-reinforced, paintable, produce no harmful fumes, be mold and mildew resistant, and shall remain flexible after curing. Exterior rated duct sealant shall include a UV resistant finish. Duct sealant shall be U.L. 181A and 181B listed.
  - 1. Manufacturers:

- a. Bostik Findley
  - b. Carlisle
  - c. Ductmate
  - d. Foster
  - e. Precision Adhesive
  - f. Polymer Adhesives
  - g. Rectorseal
- B. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
- C. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

## 2.5 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
- 1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  - 2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- B. Hanger Materials: Galvanized sheet steel or threaded steel rod.
- 1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
  - 2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
- 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  - 2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.

## 2.6 RIGID DUCT FABRICATION

- A. All concealed ductwork, except dishwasher hood duct, shall be constructed of the best galvanized sheet metal sheets, free from blisters and imperfections. Ductwork shall be installed with joints, bracing and supports in strict accordance with the recommendations of the S.M.A.C.N.A. low velocity standards.

**Minimum gauge of sheet metal shall be as specified below:**

<u>GREATEST DIMENSION</u>	<u>MIN. U. S. GAUGE</u>
0" - 12"	26
13" - 30"	24
31" - 54"	22
55" - 84"	20
85" and above	18
Plenum	22

- B. All exposed ductwork in media and cafeteria shall be round or flat oval double wall insulated lockseam duct (as noted on plans) except for transitions. Duct shall have an 18 gauge exterior wall by United McGill, Monroe Metals, Semco, or approved equal.
- C. The exterior and exposed rectangular ductwork sections shall be connected using a system consisting of minimum 20-gauge galvanized steel with an integral sealant to create an airtight transverse joint. The system shall utilize a neoprene or extruded butyl gasketing between mating flanges the entire length of the joint. The connection system shall be comparable to a S.M.A.C.N.A. class "J" transverse joint. Each transverse joint shall be protected using a continuous U.L. listed metal cleat applied over the entire joint. The system shall be by Ductmate Industries, Inc., Ward Duct Connector, Inc., Lockformer, or Engineer and Owner approved equal.
- D. All exposed ductwork shall be constructed from "Paint-Grip" type materials, and shall be painted to match surroundings.
- E. Ductwork shall be constructed for a positive pressure of 2" W.C. for supply ductwork and a negative pressure of 1" W.C. for exhaust and return ductwork. Ductwork reinforcement shall be provided as required by the SMACNA HVAC Duct Construction Standards - Metal & Flexible - Second Edition - 1995 for the pressure class and gauges listed above. **Contractor shall submit a schedule indicating duct gauge and reinforcement methods to be utilized for each duct dimension range outlined above prior to fabricating any ductwork.**
- F. Cross break flat sides of ducts. Reduction in duct size shall be made with maximum of 30 degrees slope.
- G. Turning vanes shall be used in all 90 degree square turns except exhaust ductwork.
- H. Air flow control vanes shall be installed in all short radius elbows where centerline radius is less than the width of the duct. These vanes shall be constructed of metal not lighter than the thickness of the surrounding ductwork.
- I. Duct hangers for horizontal ducts shall be not over 8'-0" o.c. #16 U.S. gauge, 1" wide for ducts 18" greater dimension and smaller, #12 U.S. gauge 1-1/2" wide for larger ducts. Duct hangers shall extend to bottom of duct.
- J. Provide 30 oz. neoprene coated glass fabric connections where ductwork connects to all power driven equipment (inlet and outlets).
- K. Flexible connectors shall be installed at points where fans connect directly to ductwork. Connector between ductwork and discharge shall be at least 4" wide made specifically for use as a flexible connector. Connections shall be air tight and made so that connector is undamaged when joint is removed.
- L. Where visible from floor, interior of ducts behind grilles or registers shall be painted flat black.
- M. Provide dampers as follows:
  - 1. Manual Damper - opposed blade, 16 ga.

2. Extractors - 100% shut-off type with adjustable turning vanes, hinged with rod, ball joint, and locking set screw anchor to be installed at each rectangular branch take-off from a rectangular main duct.
- N. Spin-in fittings shall be used for round take-offs from rectangular duct mains. Spin-ins shall include a scoop extractor and balancing damper with 2" stand-off bracket with locking quadrant and continuous square shaft with end bearings.
- O. Use of "Dove-Tail" fittings or connections is prohibited.
- P. Dishwasher exhaust ductwork shall be fabricated from minimum 18 gauge stainless steel, with all seams welded and polished.
- Q. Duct and plenum access doors shall be double wall construction of not less than 24 gauge galvanized steel sheet, with 1 inch thick neoprene coated fiberglass insulation between the walls. Doors shall have a continuous hinge on one side and cam latch with striker plate on the other side; doors with heights over 12 inches shall have a minimum of 2 cam latches with striker plates. Door frame shall be constructed of not less than 22 gauge galvanized steel with knockover edges for securing to duct. The door assembly shall be double gasketed.
- R. Exterior ductwork shall be sealed and protected with a minimum of 2 coats of elastomeric primer. All exterior and interior exposed ductwork shall be internally lined with 2" thick insulation. Dimensions indicated on plans shall be free areas.

## 2.7 FLEXIBLE DUCTWORK

- A. All flexible ductwork manufacturers shall be approved by Owners' representative and an Engineer.
- B. Flexible ductwork shall be U.L. 181 listed as a class 1 air duct. Duct shall be tested for a maximum internal operating temperature of 250 degrees F under continuous operation. Duct shall have a minimum five year warranty. Inner liner shall consist of a minimum 2.5 mil thickness plastic alloy formulated from chlorinated polyethylene and polyvinyl chloride resins (CPE) permanently bonded to a coated spring steel wire helix. Insulation shall be minimum 1" thick, 3/4 pcf density fiberglass with a minimum "R" value of 6. Outer liner shall be a fiberglass reinforced metallized vapor barrier or grey fire retardant polyethylene.
- C. Maximum allowable length of flexible duct shall be 6'-0".
- D. Flexible duct shall be designed for the following minimum service pressures:

<u>DUCT INSIDE DIAMETER</u>	<u>PRESSURE</u>
4 - 12"	10" W. C. Positive
14 - 20"	4" W. C. Positive
4 - 12"	1" W. C. Negative
14 - 20"	1/2" W. C. Negative
- E. Duct shall be as manufactured by Thermaflex, Flexmaster, Clevaflex or Atco.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
- B. Install round and flat-oval ducts in lengths not less than 12 feet unless interrupted by fittings.
- C. Install ducts with fewest possible joints.
- D. Install fabricated fittings for changes in directions, size, and shape and for connections.
- E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.
- F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building, unless noted otherwise.
- H. Install ducts with a clearance of 2 inch, plus allowance for insulation thickness.
- I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
- J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
- L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.
- N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 15 Section "Duct Accessories." Firestopping materials and installation methods are specified in Division 7 Section "Through-Penetration Firestop Systems."
- O. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Refer to SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

- P. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."
- Q. Paint interiors of metal ducts, that do not have duct liner, where visible from registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 9 painting Sections.
- R. All ductwork shall be installed parallel to the building lines and at level grades.
- S. Use of tape for sealing ductwork is strictly prohibited. Tape shall only be utilized as a partial method of securing flexible duct.
- T. Air losses from system shall not exceed 5%. Sealant shall be applied to all joints.
- U. All ductwork except exhaust ducts shall be insulated.
- V. The routing of all ductwork shall be coordinated with the work of other trades for fabrication and installation.
- W. Flexible ducts shall be installed in an extended condition free of sags and kinks, using only the minimum length required to make the connection. Abrupt bends and turns that crimp the duct and restrict air flow shall not be permitted. Horizontal supports shall be 3/4" wide, 22 gauge flat galvanized steel sheet banding material. Flexible ducts shall be supported on 36 inch centers.
- X. Sizes of duct indicated as lined shall be adjusted to accommodate liner thickness maintaining interior dimensions.
- Y. Flexible duct connections:
  - 1. Flexible duct connected to rectangular duct shall be connected to spin-in fittings.
  - 2. Flexible duct connection to rigid metal duct and fittings shall be accomplished by peeling back insulation and outer jacket, sliding duct over collar, taping a minimum of three full wraps around the perimeter of the connection, and additionally securing with a locking nylon tie strap. Next, the insulation and outer liner shall be pulled back over rigid fitting or duct, wrapped a minimum of three wraps with tape and additionally secured with a locking nylon tie strap. Tape securing flexible duct to rigid shall be U.L.181B-FX listed by Shurtape PC-857 or equal.
- Z. All wall penetrations shall be cored, drilled or cut.

### 3.2 APPLICATION OF LINER IN DUCTS

- A. All supply & return ductwork a min. of 10 feet from unit or greater as indicated on floor plans shall be insulated internally. The entire length of all exposed supply and return ductwork shall be internally lined.
- B. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.



- C. Butt transverse joints without gaps and coat joint with adhesive.
- D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping. All edges of liner exposed to air flow shall be duct tabbed with sheet metal permanently fastened to duct. Entire surface of liner shall be glued to duct.
- E. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.
- F. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
  - 1. Fan discharges.
  - 2. Intervals of lined duct preceding unlined duct.

### 3.3 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION

- A. Round, Longitudinal- and Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
  - 1. Manufacturers:
    - a. McGill AirFlow Corporation.
    - b. SEMCO Incorporated.
    - c. Monroe Metals.
    - d. Lindab Spirosafe
- B. Duct Joints:
  - 1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
  - 2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
  - 3. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
    - a. Manufacturers:
      - 1) Ductmate Industries, Inc.
      - 2) Lindab Inc.
      - 3) Ward
- C. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.
- D. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.
- E. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:

1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:
  - a. Ducts 3 to 36 Inches in Diameter: 0.034 inch.
  - b. Ducts 37 to 50 Inches in Diameter: 0.040 inch.
  - c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
  - d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.
3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:
  - a. Ducts 3 to 26 Inches in Diameter: 0.034 inch.
  - b. Ducts 27 to 50 Inches in Diameter: 0.040 inch.
  - c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
  - d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.
4. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
5. Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
6. Round Elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
7. Round Elbows Larger Than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
8. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.
9. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
10. Pleated Elbows for Sizes through 14 Inches in Diameter and Pressures through 10-Inch wg: 0.022 inch .

### 3.4 DUCT APPLICATIONS

- A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:
  1. Supply Ducts: 2-inch wg.
  2. Return Ducts (Negative Pressure): 1-inch wg.
  3. Exhaust Ducts (Negative Pressure): 1-inch wg.
- B. All ducts shall be galvanized steel except as follows:
  1. Range Hood Exhaust Ducts: Comply with NFPA 96.
    - a. Concealed: Stainless-steel sheet.
    - b. Weld and flange seams and joints.
  2. Dishwasher Hood Exhaust Ducts:
    - a. Type 316, stainless steel with finish to match kitchen equipment and range hood. Weld and flange seams and joints.
  3. Residential Range Hood – Stainless Steel, Type “B” Gas Vent , 8” round with roof curb and cap.

### 3.5 COMMERCIAL RANGE HOOD EXHAUST DUCTS, SPECIAL INSTALLATION REQUIREMENTS

- A. Install ducts to allow for thermal expansion through 2000 deg F temperature range.
- B. Install ducts without dips or traps that may collect residues unless traps have continuous or automatic residue removal.
- C. Install access openings at each change in direction and at intervals defined by NFPA 96; locate on sides of duct a minimum of 1-1/2 inches from bottom; and fit with grease-tight covers of same material as duct.
- D. Do not penetrate fire-rated assemblies except as permitted by applicable building codes.
- E. All commercial range hood exhaust ductwork shall be installed in accordance with the latest edition of NFPA 96, including construction, clearances to combustibles, access and service.

### 3.6 SEAM AND JOINT SEALING

- A. Seal all duct seams and joints with water-based sealant.
- B. Seal ducts before external insulation is applied.

### 3.7 HANGING AND SUPPORTING

- A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.
- B. Support vertical ducts at maximum intervals of 16 feet and at each floor.
- C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- D. Install concrete inserts before placing concrete.
- E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

### 3.8 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:
  - 1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
  - 2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.

3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round and flat-oval ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg .
4. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

### 3.9 CLEANING NEW SYSTEMS

- A. During construction, all exposed duct openings shall be sealed air-tight with min. 3 mil plastic secured with minimum of two full perimeter wraps of duct tape. Seal installation may be terminated when building has been proclaimed “dried in” by the Owner.
- B. Use service openings, as required, for physical and mechanical entry and for inspection.
  1. Create other openings to comply with duct standards.
  2. Disconnect flexible ducts as needed for cleaning and inspection.
  3. Remove and reinstall ceiling sections to gain access during the cleaning process.
- C. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.
- D. Clean the following metal duct systems by removing surface contaminants and deposits:
  1. Air outlets and inlets (registers, grilles, and diffusers).
  2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
  3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
  4. Coils and related components.
  5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
  6. Supply-air ducts, dampers, actuators, and turning vanes.
- E. Mechanical Cleaning Methodology:
  1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
  2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
  3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
  4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet.
  5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
  6. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.

- F. Cleanliness Verification:
1. Visually inspect metal ducts for contaminants.
  2. Where contaminants are discovered, re-clean and reinspect ducts.

END OF SECTION 15815

## **SECTION 15820 - DUCT ACCESSORIES**

### **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. Back draft dampers.
  - 2. Volume dampers.
  - 3. Motorized control dampers.
  - 4. Fire dampers.
  - 5. Ceiling fire dampers.
  - 6. Smoke dampers.
  - 7. Combination fire and smoke dampers.
  - 8. Turning vanes.
  - 9. Duct-mounting access doors.
  - 10. Flexible connectors.
  - 11. Duct accessory hardware.
- B. Related Sections include the following:
  - 1. Division 13 Section "Fire Alarm" for duct-mounting fire and smoke detectors.
  - 2. Division 15 Section "HVAC Instrumentation and Controls" for electric damper actuators.

#### **1.3 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Back draft dampers.
  - 2. Volume dampers.
  - 3. Motorized control dampers.
  - 4. Fire dampers.
  - 5. Smoke dampers.
  - 6. Combination fire and smoke dampers.
  - 7. Turning vanes.
  - 8. Duct-mounting access doors.
  - 9. Flexible connectors.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Special fittings.
  - 2. Manual-volume damper installations.

3. Motorized-control damper installations.
4. Fire-damper, smoke-damper, and combination fire- and smoke-damper installations, including sleeves and duct-mounting access doors.
5. Wiring Diagrams: Power, signal, and control wiring.

#### 1.4 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

#### 1.5 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. Fusible Links: Furnish quantity equal to 10 percent of amount installed, or a minimum of 2 whichever is greater.

### 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 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.
- B. Stainless Steel: ASTM A 480/A 480M.
- C. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: ASTM B 221, alloy 6063, temper T6.
- E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

#### 2.3 BACK DRAFT DAMPERS

- A. Manufacturers:
  1. Air Balance, Inc.

2. Penn Ventilation Company, Inc.
  3. Ruskin Company.
  4. Greenheck
  5. Arrow United
- B. Description: Multiple-blade, parallel action gravity balanced, with center-pivoted blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.
- C. Frame: 0.052-inch- thick, galvanized sheet steel, with welded corners and mounting flange.
- D. Blades: 0.050-inch- thick aluminum sheet.
- E. Blade Seals: Neoprene.
- F. Blade Axles: Galvanized steel.
- G. Tie Bars and Brackets: Galvanized steel.
- H. Return Spring: Adjustable tension.

## 2.4 VOLUME DAMPERS

- A. Manufacturers:
1. McGill AirFlow Corporation.
  2. METALAIRE, Inc.
  3. Ruskin Company.
  4. Greenheck
  5. Arrow United
- B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
1. Pressure Classes of 2-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.
- C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
  2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
  3. Blade Axles: Galvanized steel.
  4. Bearings: Oil-impregnated bronze.
  5. Tie Bars and Brackets: Galvanized steel.



- D. Jackshaft: 1-inch- diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
  - 1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.
- E. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

## 2.5 MOTORIZED CONTROL DAMPERS

- A. Manufacturers:
  - 1. McGill AirFlow Corporation.
  - 2. METALAIRE, Inc.
  - 3. Ruskin Company.
  - 4. Greenheck
  - 5. Arrow United
- B. General Description: AMCA-rated, parallel opposed-blade design; minimum of 0.1084-inch-thick, galvanized-steel frames with holes for duct mounting; minimum of 0.0635-inch- thick, galvanized-steel damper blades with maximum blade width of 8 inches.
  - 1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
  - 2. Operating Temperature Range: From minus 40 to plus 200 deg F.
  - 3. Provide closed-cell neoprene edging.
  - 4. Step down transformer shall be provided with the unit to step down from 120 volts to 24 volts.

## 2.6 FIRE DAMPERS

- A. Manufacturers:
  - 1. McGill AirFlow Corporation.
  - 2. Greenheck.
  - 3. Nailor Industries Inc.
  - 4. Ruskin Company.
  - 5. Louvers and Dampers
  - 6. Cesco
  - 7. National Controlled Air
- B. Fire dampers shall be labeled according to UL 555.
- C. Fire Rating: 1-1/2or 3 hours according to wall construction.
- D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

- E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
  - 1. Minimum Thickness: 0.138 inch thick and of length to suit application.
  - 2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.
- F. Mounting Orientation: Vertical or horizontal as indicated.
- G. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- I. Fusible Links: Replaceable, 165 deg F rated.

## 2.7 SMOKE COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers:
  - 1. Greenheck.
  - 2. Nailor Industries Inc.
  - 3. Ruskin Company.
  - 4. Louvers and Dampers
  - 5. Cesco
  - 6. United Air
  - 7. National Controlled Air
- B. General Description: Labeled according to UL 555S. Damper shall be Class II leakage and rated for 250F. Combination fire and smoke dampers shall be labeled according to UL 555 for 1-1/2-hour rating.
- C. Fusible Links: Replaceable, 165 deg F rated.
- D. Frame and Blades: 0.064-inch- thick, galvanized sheet steel.
- E. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application.
- F. Damper Motors: Modulating and two-position action.
  - 1. Comply with requirements in Division 15 Section "Motors."
  - 2. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
  - 3. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
  - 4. Electrical Connection: 24 volt.
  - 5. Step down transformer shall be provided with the unit to step down from 120 volts to 24 volts.

## 2.8 TURNING VANES

- A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.
- B. Manufactured Turning Vanes: Fabricate 1-1/2-inch- wide, single-vane, curved blades of galvanized sheet steel set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into vane runners suitable for duct mounting.
  - 1. Manufacturers:
    - a. Ductmate Industries, Inc.
    - b. METALAIRE, Inc.
    - c. Ward Industries, Inc.
- C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

## 2.9 DUCT-MOUNTING ACCESS DOORS

- A. General Description: Fabricate doors airtight and suitable for duct pressure class.
- B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.
  - 1. Manufacturers:
    - a. Ductmate Industries, Inc.
    - b. McGill AirFlow Corporation.
    - c. Nailor Industries Inc.
    - d. Acudor
    - e. Greenheck
  - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
  - 3. Provide number of hinges and locks as follows:
    - a. Less Than 12 Inches Square: Secure with two sash locks.
    - b. Up to 18 Inches Square: Two hinges and two sash locks.
    - c. Up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
    - d. Sizes 24 by 48 Inches and Larger: Same as "C" above, but with one additional hinge.
- C. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.
- D. Insulation: 1-inch- thick, fibrous-glass or polystyrene-foam board.

## 2.10 FLEXIBLE CONNECTORS

- A. Manufacturers:
  - 1. Ductmate Industries, Inc.
  - 2. Ward Industries, Inc.
  - 3. Carlisle Hardcast

- B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- C. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
  - 1. Minimum Weight: 26 oz./sq. yd. .
  - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
  - 3. Service Temperature: Minus 40 to plus 200 deg F.

## 2.11 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## PART 3 - EXECUTION

### 3.1 APPLICATION AND INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.
- B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- D. Install volume dampers in ducts with liner; avoid damage to and erosion of duct liner.
- E. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.
- F. Provide test holes at fan inlets and outlets and elsewhere as required for balancing.
- G. Install fire and smoke dampers, with fusible links, according to manufacturer's UL-approved written instructions. Install duct mounted smoke detectors per the detector manufacturer's requirements.
- H. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories as follows:
  - 1. Within 12" on both sides of duct coils.
  - 2. Downstream from volume dampers.
  - 3. Within 12" of fire or smoke dampers, providing access to reset or reinstall fusible links.

4. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot spacing.
  5. On sides of ducts where adequate clearance is available.
  6. **Access door shall be labeled minimum ½" letters. The label shall indicate what unit the access door serves.**
- I. Install the following minimum sizes for duct-mounted, rectangular access doors:
    1. Two-Hand Access: 12 by 6 inches.
  - J. Label access doors according to Division 15 Section "Mechanical Identification."
  - K. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.
  - L. Motorized actuator's step-down transformer shall be provided and installed by Div.15 for Div 16 to connect 120 volt power.

### 3.2 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Adjust fire and smoke dampers for proper action.
- C. Final positioning of manual-volume dampers is specified in Division 15 Section "Testing, Adjusting, and Balancing."

END OF SECTION 15820

## **SECTION 15838 – POWER VENTILATORS**

### **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. Centrifugal roof ventilators.
  - 2. Ceiling-mounting ventilators.
  - 3. In-line centrifugal fans.
  - 4. Kiln Ventilation System

#### **1.3 PERFORMANCE REQUIREMENTS**

- A. Project Altitude: Base fan-performance ratings on 1,000 feet above sea level.
- B. Operating Limits: Classify according to AMCA 99.

#### **1.4 SUBMITTALS**

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
  - 1. Certified fan performance curves with system operating conditions indicated.
  - 2. Certified fan sound-power ratings.
  - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 4. Material thickness and finishes, including color charts.
  - 5. Dampers, including housings, linkages, and operators.
  - 6. Roof curbs.
  - 7. Fan speed controllers.
- B. Field quality-control test reports.
- C. Operation and Maintenance Data: For power ventilators 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.

- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
  - 1. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- C. UL Standard: Power ventilators shall comply with UL 705.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

#### 1.7 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

#### 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. Belts: One set(s) for each belt-driven unit.

### PART 2 - PRODUCTS

#### 2.1 CENTRIFUGAL ROOF VENTILATORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1. Acme Engineering & Mfg. Corp.
  - 2. Greenheck.
  - 3. Loren Cook Company.
  - 4. Penn Ventilation.
  - 5. Twin City
- B. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories. Units shall be up-blast design unless noted otherwise by schedule.

- C. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone. Cabinet and hood shall be painted to match adjacent roofing materials. Color selection to be made by Architect. Forward color selection chart to Architect prior to ordering units.
  - 1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.
  - 2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.
- D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- E. Accessories:
  - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
  - 2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
  - 3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
  - 4. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.
- F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.
  - 1. Configuration: Self-flashing without a cant strip, with mounting flange.
  - 2. Overall Height: 18 inches.
  - 3. Curbs on metal roofs shall be painted to match roof.

## 2.2 CEILING-MOUNTING VENTILATORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1. Acme Engineering & Mfg. Corp.
  - 2. Greenheck.
  - 3. Loren Cook Company.
  - 4. Penn Ventilation.
  - 5. Twin City
- B. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.
- C. Housing: Steel, lined with acoustical insulation.
- D. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- E. Grille: Plastic or painted aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.



- G. Accessories:
  - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
  - 2. Isolation: Rubber-in-shear vibration isolators.
  - 3. Manufacturer's standard roof jack or wall cap, and transition fittings.

## 2.3 IN-LINE CENTRIFUGAL FANS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1. Acme Engineering & Mfg. Corp.
  - 2. Greenheck.
  - 3. Loren Cook Company.
  - 4. Penn Ventilation.
  - 5. Twin City
- B. Description: In-line, direct or belt-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.
- C. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- D. Direct-Driven Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
- E. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
- F. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- G. Accessories:
  - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
  - 2. Companion Flanges: For inlet and outlet duct connections.
  - 3. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

## 2.4 MOTORS

- A. Comply with requirements in Division 15 Section "Motors."
- B. Enclosure Type: Totally enclosed, fan cooled.

## 2.5 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

## 2.6 ROOF MOUNTING CURBS

- A. Provide a pre-fabricated, insulated, 12 gauge galvanized steel roof mounting curb for all roof mounted equipment. Duct support members shall be provided to allow for pre-hanging of ductwork prior to unit installation. Provide gasketing to form a positive, weather tight seal between the curb and unit base. Design shall comply with all requirements of the National Roofing Contractors Association. Base of curb shall conform to roof slope and provide a level base on which to mount equipment. Curb overall height (from roof structure to top of curb) shall provide a min. 10" clearance between the top of the curb and the finished roof surface or the minimum height required to meet the roofing bond specifications, whichever is greater.
- B. Insulation shall be 1-1/2 inch thick, 3-lb. density rigid type. Nailer shall be constructed of pressure treated wood.
- C. All roof mounting curbs shall comply with requirements of architectural division of the specifications. All roof curbs shall be approved by the Architect prior to placing order for construction.
- D. Curbs on metal roofs shall be painted to match roof.

## 2.7 KILN HOOD

- A. Hood shall be semi-portable type including suspended hood, two speed motor / blower assembly, venting hose, and overhead pulley system, and swinging wall bracket assembly.
- B. Hood shall be constructed of spun aluminum alloy. Hood diameter shall be a minimum of 54" diameter.
- C. Venting hose shall include aluminum inner and outer surfaces. Unit shall include control switch and plug, venting kit including all necessary clamps. Overhead bracket shall be constructed of 1" square tubing including necessary suspension wire, clips, and steel counterweight.
- D. System shall include a nominal 500 CFM exhauster with 1/10 H.P. motor, a spun aluminum hood, 2 speed wall mounted fan controller, overhead counterweight pulley system, wall brackets, 10' of 6" flexible hose, and mounting plates and accessory hardware.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 7 Section "Roof Accessories" for installation of roof curbs.

- C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- D. Support suspended units from structure using threaded steel rods and spring hangers with vertical-limit stops having a static deflection of 1 inch. Vibration-control devices are specified in Division 15 Section "Mechanical Vibration and Seismic Controls."
- E. Install units with clearances for service and maintenance.
- F. Label units according to requirements specified in Division 15 Section "Mechanical Identification."
- G. Install kiln ventilation system as recommended by the manufacturer. Verify kiln location prior to installing hood. Trim excess exhaust hose to ensure smooth duct radius. Install wall bracket true and plumb to ensure the hood remains centered over the kiln. Verify exact kiln dimensions prior to ordering hood.

### 3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 15 Section "Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Division 16 Section "Grounding and Bonding."
- D. Connect wiring according to Division 16 Section "Conductors and Cables."

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Verify that shipping, blocking, and bracing are removed.
  - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  - 3. Verify that cleaning and adjusting are complete.
  - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
  - 5. Adjust belt tension.
  - 6. Adjust damper linkages for proper damper operation.
  - 7. Verify lubrication for bearings and other moving parts.
  - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
  - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
  - 10. Shut unit down and reconnect automatic temperature-control operators.
  - 11. Remove and replace malfunctioning units and retest as specified above.

- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

#### 3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION 15838

## SECTION 15855 - DIFFUSERS, REGISTERS AND GRILLES

### 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 ceiling- and wall-mounted diffusers, registers, and grilles.
- B. Related Sections include the following:
  - 1. Division 10 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts. Louvers indicated on mechanical plans by model number shall be under Division 15.
  - 2. Division 15 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

#### 1.3 SUBMITTALS

- A. Product Data: For each product indicated, include the following:
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - 2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, quantity, model number, size, and accessories furnished.

### 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 GRILLES AND REGISTERS

- A. Adjustable Bar Grilles & Registers
  - 1. Manufacturers:
    - a. Krueger.
    - b. Price Industries.
    - c. Titus.

- d. Nailor
  - 2. Material: Steel & Aluminum.
  - 3. Finish: Baked enamel, white.
  - 4. Blade Arrangement: As scheduled on drawings.
  - 5. Rear Blade Arrangement: As scheduled on drawings.
  - 6. Frame: As scheduled on drawings.
  - 7. Mounting Frame: As scheduled on drawings.
  - 8. Mounting: As scheduled on drawings.
  - 9. Damper Type: As scheduled on drawings.
- B. Fixed Face Grille & Register:
- 1. Manufacturers:
    - a. Krueger.
    - b. Price Industries.
    - c. Titus.
    - d. Nailor
  - 2. Material: Steel & Aluminum.
  - 3. Finish: Baked enamel, white.
  - 4. Face Arrangement: As scheduled on drawings.
  - 5. Frame: As scheduled on drawings.
  - 6. Mounting Frame: As scheduled on drawings.
  - 7. Mounting: As scheduled on drawings.
  - 8. Damper Type: As scheduled on drawings.

## 2.3 CEILING DIFFUSER OUTLETS

- A. Rectangular and Square Ceiling Diffusers:
- 1. Manufacturers:
    - a. Krueger.
    - b. Price Industries.
    - c. Titus.
    - d. Nailor
  - 2. Material: Steel & Aluminum.
  - 3. Finish: Baked enamel, white.
  - 4. Face Size: As scheduled on drawings.
  - 5. Face Style: As scheduled on drawings.
  - 6. Mounting: As scheduled on drawings.
  - 7. Pattern: As scheduled on drawings.
  - 8. Dampers: As scheduled on drawings.
- B. Louver Face Diffuser:
- 1. Manufacturers:
    - a. Krueger
    - b. Price Industries.
    - c. Titus.
    - d. Nailor
  - 2. Material: Steel & Aluminum.
  - 3. Finish: Baked enamel, white.
  - 4. Face Size: As scheduled on drawings.
  - 5. Mounting: As scheduled on drawings.

6. Pattern: As scheduled on drawings.
7. Dampers: As scheduled on drawings.
8. Accessories:
  - a. Square to round neck adaptor.
  - b. Adjustable pattern vanes.

2.4 CONCENTRIC DIFFUSERS – Refer to drawings for details.

2.5 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

### PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. Locate units per architectural plans. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 15855

## **SECTION 15860 – BI-POLAR IONIZATION UNITS**

### **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 describes the design, performance and installation of an air purification system intended for use as part of another manufacturer's air handling unit, including, but not limited to fan-coils and other air handling equipment as shown on the plans, details or equipment schedules.

#### **1.3 RELATED WORK**

- A. Testing, balancing and inspection services
- B. Facility Access and Protection
- C. Duct work
- D. Electrical Wiring
- E. Control Wiring

#### **1.4 SUBMITTALS**

- A. Product Data: Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.
- B. Third party verified test data showing that the system submitted complies with ASHRAE Standard 62.1-2007 requirements for the indoor air quality procedure. Also, computer selections of each application where the equipment is used (Classrooms, Offices, Cafeterias, etc.) shall be submitted.
- C. Product performance data for filters, gauges and housings.
- D. Product drawings detailing all physical, electrical, duct work and control requirements.
- E. Manufacturer's Follow-up Service Program details.



1.5 REFERENCE TO CODES AND STANDARDS

- A. ASHRAE Standards 62 & 52
- B. UL Standard 867
- C. CFR 39-75 Title 21 April 17, 1974
- D. National Electric Code NFPA 70, 1990

1.6 QUALITY ASSURANCE

- A. The Air Purification System shall be a product of an established manufacturer with installations in successful operation in the USA. Technologies that do not address gas disassociation such as UV Lights, Powered Particulate Filters and/or polarized media filters shall not be considered.
- B. A qualified representative from the manufacturer shall be available to inspect the installation of the air purification system to ensure installation in accordance with manufacturer's recommendation.
- C. The complete air purification system including the bi-polar ionization unit and remote monitor as assembled, complete with power and control wiring, safety switches, airflow switches and controls shall be listed by either UL or Intertek/ETL for conformance to UL 867-2007.
- D. Provide Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.2- 2007 to validate acceptable indoor air quality at the quantity of outside air scheduled.

1.7 WARRANTY

- A. Equipment shall be warranted by the manufacturer against defects in material and workmanship for a period of twelve months after shipment or eighteen months for Owner acceptance, whichever occurs first.

1.8 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver in factory fabricated shipping containers. Identify on outside of container the type of product and location where it is to be installed. Do not crush or bent product or container.
- B. Store in original cartons and protect from weather and construction work traffic.
- C. Store indoors and in accordance with the manufacturer's recommendations for storage.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Equals are, as follows below, provided they meet all requirements of this specification. The contractor shall be responsible for any additional costs associated with substitution from the basis of design. All other alternate manufacturers submitted for substitution must provide their ASHRAE 62.1-2007 calculations that prove conformance to the ASHRAE Standard with the reduction of outside air to the scheduled values. A letter on the manufacturer's letterhead requesting prior approval must accompany the request for prior approval stating their calculations are ASHRAE compliant and an independent validation study has been performed to validate the accuracy of the ASHRAE modeling software. Subject to compliance with requirements, provide products by one of the following manufacturers:
1. Plasma-Air
  2. Atmos Air
  3. Global Plasma Solutions

### 2.2 DESCRIPTION

- A. Each piece of air handling equipment ( rooftop units, VRF terminals, wall hung package units, ductless split systems), shall contain a bi-polar ionization or plasma generator with bi-polar ionization system capable of:
1. Effectively killing microorganisms throughout cooling coil, drain pan and supply duct (mold, bacteria, virus, etc.).
  2. Controlling gas phase contaminants generated from human occupants, building structure and furnishings.
  3. Capable of reducing static space charges.
- B. Air Exchange Rate
1. Air exchange rates may vary through the full operating range of a constant volume or VAV system. The quantity of air exchange shall not be increased due to requirements of the air purification system.
- C. Velocity Profile
1. The air velocity through the plenum approaching the air purification system shall not exceed 1,000 fpm (5 m/s) in the bi-polar ionization section.
- D. Humidity
1. Ion tubes and pinpoint electrodes shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 99% shall not cause damage, deterioration or dangerous conditions within the air purification system.

### 2.3 EQUIPMENT REQUIREMENTS

- A. Electrode Specifications
1. Each bi-polar ionization unit shall include the required number of electrodes and power generators sized to the air handling equipment capacity. Electrodes shall be installed in pairs to create the required dielectric. Electrodes that may corrode are not acceptable.

2. Electrical power to the electrodes shall be interrupted when the airflow is less than 100 fpm or when access doors to the electrode plenum section are opened.
- B. Duct, Unit Casing, or Plenum Mounted Units
1. Where so indicated on the plans and/or schedules, duct mounted ionization filtration unit(s) shall be supplied and installed. The generator shall be installed in a convenient location above the ceiling for visual indication of power, removal and servicing. Filtration on any equipment requiring bi-polar ionization shall be MERV 6 or better.
    - a. Ion generators shall have ionization status indication lights, fuse with fuse holder, external alarm connector and test jack on the bottom or side; visible on the exterior of the duct or unit. The units shall be supplied with a permanent base that is mounted to the duct or unit casing for ease in removal and replacement of the ion generator for servicing. The permanent base shall incorporate an electrical outlet with junction box for power.
    - b. Each unit shall be UL listed for assembly installation in a return air plenum.

## 2.4 IONIZATION REQUIREMENTS

- A. Bi-Polar Ionization Generator(s)
1. Bi-polar ionization generator(s), capable of controlling gas phase contaminants, shall be provided for all equipment.
  2. The bi-polar ionization system shall consist of ionization tubes (in systems requiring tubes), power generators, remote monitor and power regulator, safety door switches, airflow switches, and other accessories required for safe and efficient operation.
  3. Provide test jacks with a 1 to 4 volt output to indicate high voltage output with a standard multimeter on all units other than small self contained units which utilize type self contained filters.
  4. The self contained generators, located at each duct location, shall be so designed so that the electrodes must be disconnected prior to removal of the unit.
  5. Each ion generator shall be provided with a 14G galvanized steel mounting plate with rib nuts and junction box that shall permanently mount to the duct. Removal of the ion generator for servicing shall not require removal of the base plate. All wiring between the junction box and unit shall be in metal flexible conduit or shall use MC cable. When tubes are utilized, there shall be adequate additional cable to allow removal of the unit with tube installed. Machine screws shall secure the ion generator to the mounting plate such that stripping of the duct will not occur over time due to standard maintenance procedures.
  6. Provide an isolation transformer for each bi-polar ionization unit serving an A/C unit providing 1601 cfm and higher Ozone Generation
- B. The operation of the electrodes or bi-polar ionization units shall conform to ASHRAE Standard 62.1 and CFR 39-75 with respect to ozone generation.

## 2.5 ELECTRICAL REQUIREMENTS

- A. Wiring, conduit and junction boxes shall be installed within housing plenums in accordance with NEC NFPA 70. Units shall be provided at the voltage and phase available. Electrical service shall be coordinated with the mechanical contractor and electrical contractor prior to ordering equipment. In the event line voltage varies 10% or greater from nominal or when

electrical spikes or transients are present power conditioning shall be provided at no additional increase to the contract.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. The units shall be installed in accordance with the manufacturer's instructions by the mechanical contractor. The electrical contractor shall complete single point power connections to the units.
- B. All equipment shall be assembled and installed in a workman like manner to the satisfaction of the owner, architect, and consulting engineer.
- C. Any material damaged by handling, water or moisture shall be replaced, by the mechanical contractor, at no cost to the owner.
- D. All equipment shall be protected from dust and damage on a daily basis throughout construction.
- E. Clean all components prior to commissioning.
- F. Install electrodes when commissioning air purification system.
- G. Coordinate mounting and power wiring details for individual rooftop units, VRF terminals, wall hung packaged A/C units and ductless split system.

#### 3.2 TESTING

- A. Provide the manufacturers recommended electrical and static pressure tests.

#### 3.3 COMMISSIONING & TRAINING

- A. A manufacturer's authorized representative shall provide start-up supervision and training of owner's personnel in the proper operation and maintenance of all equipment.
- B. Provide 5 copies of Operating and Maintenance Manuals.
- C. Warranty and Service
  - 1. A manufacturer's authorized service representative shall provide service support to insure satisfactory air purification system operation. The service program shall include, at a minimum, factory startup and commissioning, bi-annual site visits for a period of four years, inspection of the air purification system and air handling equipment, monitoring and validation, inspection of protected areas, replacement of bad tubes and generator, and the submission of a written report to the owner and consulting engineer of record. This service shall include the replacement of all the tubes at the end of the fourth year (labor and tubes). The service contract shall begin when project substantial completion has been granted.

2. Submit the Manufacturer's Service Program if requesting during the prior approval period.

#### 3.4 CLEANING

- A. After completing system installation and testing, adjusting, and balancing air-handling and air-distribution systems and at accepted substantial completion, clean filter housings and install new filter media.

END OF SECTION 15860

## **SECTION 15861 - AIR FILTERS**

### **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 factory-fabricated air-filter devices and media used to remove particulate matter from air for HVAC applications.
- B. Provide filtration products for all moving equipment. Filtration products shall be as recommended by the manufacturer, unless specified differently in the individual equipment specifications. All filters shall be new at substantial completion of the project, and one set of replacement filters shall be provided for the Owner. All filters used during the construction of the facility shall be removed and replaced at the time of Owner occupancy.

#### **1.3 SUBMITTALS**

- A. Product Data: Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.
- B. Operation and Maintenance Data: For each type of filter rack to include in operation, and maintenance manuals.

#### **1.4 QUALITY ASSURANCE**

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air filters and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- B. Comply with ARI 850.
- C. Comply with ASHRAE 52.1 and ASHRAE 52.2 for method of testing and rating air-filter units.
- D. Comply with NFPA 90A and NFPA 90B.

#### **1.5 COORDINATION**

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

## 1.6 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.

- 1.7 Provide one complete set of filters for each filter bank. If system includes pre-filters, provide only pre-filters.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
  - 1. Air Filters, Electrostatic Air Cleaners, and Filter-Holding Systems:
    - a. AAF International.
    - b. Filtration Group.
    - c. Airguard Industries, Inc.
    - d. Research Products Corp.

### 2.2 EXTENDED-SURFACE, DISPOSABLE PANEL FILTERS

- A. Description: Factory-fabricated, dry, extended-surface filters with holding frames.
- B. Media: Fibrous material formed into deep-V-shaped pleats with anti-microbial agent and held by self-supporting wire grid.
- C. Media and Media-Grid Frame: Cardboard.
- D. Duct-Mounting Frames: Welded, galvanized steel with gaskets and fasteners, and suitable for bolting together into built-up filter banks.

### 2.3 SIDE-SERVICE HOUSINGS

- A. Description: Factory-assembled, side-service housings, constructed of galvanized steel, with flanges to connect to duct system.
- B. Access Doors: Continuous gaskets on perimeter and positive-locking devices. Arrange so filter cartridges can be loaded from either access door.
- C. Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames to prevent bypass of unfiltered air.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install filter frames according to manufacturer's written instructions.
- B. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
- C. Install filters in position to prevent passage of unfiltered air.
- D. Coordinate filter installations with duct and air-handling unit installations.
- E. During construction unit filters shall be periodically changed while the unit is in operation. This shall include unit filter as well as a filter media to be placed over the return grilles. The unit filter and filter media shall be dated at each replacement. If the ductwork or evaporator coil becomes dirty, the contractor shall clean the ductwork and coil. The contractor shall provide the owner a letter stating that all coils have been inspected and are clean at Substantial Completion.

#### 3.2 CLEANING

- A. After completing system installation and testing, adjusting, and balancing air-handling and air-distribution systems and at accepted substantial completion, clean filter housings and install new filter media.

END OF SECTION 15861



## **SECTION 15900 - HVAC INSTRUMENTATION AND CONTROLS**

### **PART 1 - GENERAL**

#### **1.1 OVERVIEW**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.
- B. This document contains the specification and input/output summaries for a Building Automation System (BAS) for:  
**Dade County Board of Education**
- C. The system shall provide the Direct Digital Control (DDC), Energy Management and Building Automation System (BAS) for the air conditioning, heating and ventilating systems and shall interface with other microprocessor based building subsystems as detailed in the Input/Output Summaries and as specified herein. All damper and valve actuators shall be electronic.
- D. Main communication control panel shall be powered from the emergency generator for continuous operation.

#### **1.2 INSTRUCTIONS TO BIDDERS**

- A. The system specified in this document shall be native BACnet architecture providing full operator access via the Internet or Local Area Network utilizing only a browser for full operator access and control in through a thin-client architecture. The system shall be the **web based system furnished and installed by Electronic Controls Inc.** The requirements are described in this specification. No deviations from this specification are acceptable.
- B. Contact Information:
  - ECI (Electronic Controls, Inc.)
  - Rep: Wade Walraven
  - 4129 South Creek Road
  - Chattanooga, TN 37406
  - Phone (423) 629-4014

#### **1.3 SCOPE OF WORK**

- A. Contractor's Responsibilities
  - 1. The Contractor shall furnish and install all necessary software and hardware, wiring, and computing equipment in compliance with this specification. Any variances from this specification or related documentation shall be submitted in writing at the time of bid.
- B. System Requirements
  - 1. Standard Material/Products. All material and equipment used shall be standard components, regularly manufactured and available, and not custom designed especially for this project

2. Modular Design. The system architecture shall be fully modular permitting expansion of application software, system peripherals, and field hardware.
3. Performance. The system, upon completion of the installation and prior to acceptance of the project, shall perform all operating functions as detailed in this specification.

C. Equipment

1. System Hardware

- a. The Contractor shall provide the following:
  - 1) PC's, server(s), routers, modems and control modules as specified.
  - 2) All sensing devices, relays, switches, indicating devices, and transducers required to perform the functions as listed in the sequence of operations.
  - 3) All monitoring and control wiring.

2. System Software

- a. The Controls Contractor shall provide all software identified in Part 2 of this specification, including the BAS Server, fully configured database, graphics, reports, alarm/events. The Graphical User Interface (GUI) shall be completely Web based as specified herein.

D. Codes and Regulations

1. Standards Authority. All electrical equipment and material, and its installation, shall conform to the current requirements of the following authorities:
  - a. Occupational Safety and Health Act (OSHA)
    - 1) National Electric Code (NEC)
    - 2) National Fire Code
    - 3) Uniform Mechanical Code
    - 4) Uniform Building Code
    - 5) Uniform Plumbing Code
2. Product Applicable Standards. All distributed, standalone and unitary controllers supplied shall be in compliance with the following listings and standards:
  - a. UL916 for Open Energy Management (for U.S. and Canada)
  - b. FCC Part 15, Sub-Part B, Class A
  - c. CE Electro Magnetic Compatibility
3. Manufacturer's Quality System. The control system manufacturer shall be ISO9001 listed for design and manufacture of environmental control systems for precise control and comfort, indoor air quality, HVAC plant operation, energy savings and preventative maintenance. ISO Certification shall be by a registrar that is accredited by an internationally recognized organization such as RAB. Copy of ISO9001 certificate shall be submitted with bid.
4. Conflict of Codes. Where two or more codes conflict, the most restrictive shall apply. Nothing in this specification or related documentation shall be construed to permit work not conforming to applicable codes.

1.4 GENERAL CONDITIONS

A. Changes in Scope of Work

1. Any changes in the scope of work must be authorized by a written Change Order.
2. Correction of Work
  - a. Contractor's Responsibility. The Contractor shall promptly correct all work found defective or failing to conform to the Contract Documents. The Contractor shall bear all cost of correcting such work.

- b. During Warranty. If, within the warranty period required by the Contract Documents, any of the work is found to be defective or not in accordance with the Contract Documents, the Contractor shall correct it promptly after receipt of a written notice to do so.
- B. Coordination of Work During Construction
  - 1. The Contractor shall coordinate any necessary changes in work scheduling to minimize disruption.
  - 2. The Contractor shall protect the installed works by other trades.
    - a. The Contractor shall coordinate with other trades.
    - b. The Contractor shall repair any damage caused by his work to building(s) and equipment at no additional cost to the owner.
- C. Warranty
  - 1. The Contractor shall warrant, from the date of final acceptance, that all systems, subsystems, component parts, and software are fully free from defective design, materials, and workmanship for a period of one year or longer as indicated in this specification.
  - 2. In addition, contractor shall provide an additional 5-year parts warranty on all energy management system components.

#### 1.5 SUBMITTALS, DOCUMENTATION, ACCEPTANCE AND TRAINING

- A. Submittals
  - 1. Shop Drawings. A minimum of seven (7) copies of shop drawings shall be submitted and shall consist of a complete list of equipment, materials, manufacturer's technical literature, cut-sheets, and installation instructions. Drawings shall contain proposed layout, complete wiring, routing, schematic diagrams, tag number of devices, software descriptions, calculations, installation details, and any other details required to demonstrate that the system will function properly.
  - 2. Graphical Programming Documentation: The Contractor shall provide a printout all Graphical Programs, identifying the specific HVAC or mechanical/electrical subsystem being controlled
  - 3. Drawing Approval. Shop drawings shall be approved before any equipment is installed. Controls contractor shall allow a minimum of fourteen (14) days for drawing approval.
  - 4. As Built Drawings. All drawings shall be reviewed after the final system checkout and updated or corrected to provide 'as-built' drawings to show exact installation. All shop drawings will be acknowledged in writing before installation is started and again after the final checkout of the system. The system will not be considered complete until the 'as-built' drawings have received their final approval. The Contractor shall deliver 6 sets of 'as-built' drawings.
- B. Documentation
  - 1. Operating and Maintenance (O&M) manuals for the system shall be made available electronically using Acrobat (PDF) format and include the following categories: Workstation User's Manual, Project Engineering Handbook, Software Documentation.
  - 2. BAS User's Manual shall contain as a minimum:
    - a. System overview
    - b. Networking concepts
    - c. Launching a web browser from a networked PC/PDA and login

- d. Graphical User Interface (GUI) screen menus and their definitions
    - e. Creating, modifying or deleting schedules
    - f. Uploading and downloading software to the field hardware
    - g. Creating historical trends, collecting trend data and generating trend graphs
    - h. Enabling and assigning alarms and messages to reporting actions/groups
    - i. Report generation and 'third party software'
    - j. Backing up software and data files
  - 3. Project Engineering Manual shall contain as a minimum:
    - a. System architecture overview
    - b. Hardware cut-sheets and product descriptions
    - c. The Contractor shall deliver six (6) sets of 'as-built' drawings. All drawings shall be reviewed after the final system checkout and updated to provide 'as-built' drawings. The system will not be considered complete until the 'as-built' drawings have received their final approval.
    - d. Installation, mounting and connection details for all field hardware and accessories
    - e. Commissioning, setup and backup procedures for all control modules/accessories, BAS server software, and database.
    - f. Listing of basic terminology, alarms/messages, error messages and frequently used commands or shortcuts.
  - 4. BAS Software Documentation shall contain as a minimum:
    - a. The Contractor shall provide a printout all Graphical Programs, detailing their application to specific HVAC equipment and electrical/mechanical subsystems, together with a glossary or icon symbol library detailing the function of each graphical icon. Revisions made as a result of the submittal process, during the installation, start-up or acceptance portion of the project, shall be accurately reflected in the "as-builts".
    - b. Graphical representation of the mechanical equipment hierarchy for the project including all equipment controlled by the BAS. For example: a VAV terminal box may be the source for increased cooling demand and require the primary VAV AHU to operate which, in turn, requires the chillers to operate.
    - c. Detailed listing of all alarm and event messages programmed for designated mechanical/electrical equipment and required operator action.
- C. Acceptance Test
  - 1. Acceptance Testing. Upon completion of the installation, the Contractor shall start up the system and perform all necessary calibration, testing, and debugging operations. The Contractor in the presence of the Owner's representative shall perform an acceptance test.
  - 2. Notice of Completion. When the system performance is deemed satisfactory, the system parts will be accepted for beneficial use and placed under warranty. At this time, a "notice of completion" shall be issued and the warranty period shall start.
- D. System Training
  - 1. System Use Instructions: Controls Contractor shall provide 24 Hours of training for designated personnel in the operation, maintenance, and programming of the system.

## PART 2 - PRODUCTS - BAS SERVER & WEB BROWSER GUI

### 2.1 SYSTEM OVERVIEW

- A. The BAS contractor shall provide system software based on a server/thin-client architecture, designed around the open standards of web technology. The BAS server shall communicate using ASHRAE's BACnet/IP protocol. Server shall be accessed using a web browser over the DDC system intranet provided under this contract and remotely over the Internet.
- B. The intent of the thin-client architecture is to provide the operator(s) complete access to the BAS system via a web browser. The thin-client web browser Graphical User Interface (GUI) shall be browser and operating system agnostic, meaning it will support Microsoft Internet Explorer browsers (6.x or later versions), and Windows as well as non-Windows operating systems. No special software, (active-x components or fat java clients) shall be required to be installed on the PC's / PDA's used to access the BAS via a web browser.
- C. The BAS server software must support at least the following server platforms (Windows NT, Sun Solaris and Linux). The BAS server software shall be developed and tested by the manufacturer of the system standalone controllers and network controllers/routers. Third party manufactured and developed BAS software is not acceptable.
- D. The web browser GUI shall provide a completely interactive user interface and must offer the following features as a minimum:
  - Trending
  - Scheduling
  - Downloading Memory to field devices
  - Real time 'live' Graphic Program Diagnostics for troubleshooting
  - Tree Navigation
  - Parameter change of properties
  - Setpoint Adjustments
  - Alarm / Event information
  - Configuration of operators
  - Execution of global commands
- E. Software Components
  - 1. All software components of the BAS system software shall be installed and completed in accordance with the specification. BAS system components shall include:
    - a. Server Software, Database and Web Browser Graphical User Interface
    - b. System Configuration Utilities for future modifications to the system
    - c. Graphical Programming
    - d. Direct digital control software
    - e. Application Software
- F. BAS Server Database
  - 1. The BAS server software shall utilize a Java DataBase Connectivity (JDBC) compatible database such as: MS Access, MS SQL 7.0, Oracle 8i or IBM DB2. BAS systems written to Proprietary databases are **NOT** acceptable.

- G. Database Open Connectivity
  - 1. The BAS server database shall be Java DataBase Connectivity (JDBC) compatible, allowing real time access of data via the following standard mechanisms:
    - a. Common Object Request Broker Architecture (CORBA)
    - b. OLE/OPC (for Microsoft Client's/Server platform only)
    - c. Import/Export of the database from or to XML (extensible Mark-up Language)
- H. Communication Protocol(s)
  - 1. The native protocol for the BAS server software shall be BACnet as defined by ASHRAE standard SPC135. In addition, the software shall be able to support concurrent operation of multiple standard and non-standard protocols such as:
    - a. MODBUS
    - b. SMNP
- I. Cross Platform Capability
  - 1. The BAS system software (client and server) shall be operating system and hardware agnostic, being able to run on Windows 98, Windows 2000, Windows NT, Sun Microsystems Solaris and Red Hat Linux
- J. Thin Client – Web Browser Based
  - 1. The GUI shall be thin client or browser based and shall meet the following criteria:
    - a. Web Browser's for PC's: Only a 6.x browser (Explorer/Navigator) will be required as the GUI, and a valid connection to the server network. No installation of any custom software shall be required on the operator's GUI workstation/client. Connection shall be over an intranet or the Internet. A firewall shall be installed (as necessary) to protect the customer's Intranet.
    - b. Secure Socket Layers: Communication between the Web Browser GUI and BAS server shall be encrypted using 128-bit encryption technology within Secure Socket Layers (SSL). Communication protocol shall be Hyper-Text Transfer Protocol (HTTP).
    - c. PDA's: BAS Server software must support other browsers used by Personal Digital Assistants like 3Com Palm Pilots and other Internet appliances specified herein.

## 2.2 WEB BROWSER GRAPHICAL USER INTERFACE

- A. Web Browser Navigation
  - 1. The Thin Client web browser GUI shall provide a comprehensive user interface. Using a collection of web pages, it shall be constructed to "feel" like a single application, and provide a complete and intuitive mouse/menu driven operator interface. It shall be possible to navigate through the system using a web browser to accomplish **2.2 B thru 2.2 J** of this specification. The Web Browser GUI shall (as a minimum) provide a Navigation Pane for navigation, and a Action Pane for display of animated graphics, schedules, alarms/events, live graphic programs, active graphic setpoint controls, configuration menus for operator access, reports, and reporting actions for events.
- B. Login
  - 1. On launching the web browser and selecting the appropriate domain name or IP address, the operator shall be presented with a login page that will require a login name and

password. Navigation in the system shall be dependent on the operator's role privileges, and geographic area of responsibility (see 3.2 J below).

C. Navigation Pane

1. The Navigation Pane shall comprise a Navigation Tree which defines a geographic hierarchy of the proposed BAS system. Navigation through the GUI shall be accomplished by clicking on appropriate level of a navigation tree (consisting of expandable and collapsible tree control like Microsoft's Explorer program), and/or by selecting dynamic links to other system graphics. Both the navigation tree and graphic pane defined in 2.2 D shall be displayed simultaneously, enabling the operator to select a specific system or equipment, and view the graphic corresponding to the highlighted position in the navigation tree. The navigation tree shall as a minimum provide the following views: Geographic, Network, Groups and Configuration.
2. Geographic View shall display a logical geographic hierarchy of the system including cities, sites, buildings, building systems, floors, equipment and BACnet objects.
3. Network View shall display the hierarchy of the actual BACnet IP Intranet network. This can include: Systems, Site, Networks, Routers, Half-Routers, Devices, Equipment and all the BACnet Objects in a device.
4. Groups View shall display Scheduled Groups and custom reports.
5. Configuration View shall display all the configuration categories (Operators, Schedule, Event, Reporting and Roles).

D. Action Pane

1. The Action Pane shall provide several functional views for each HVAC or mechanical/electrical subsystem specified. By clicking on a button, an operator shall be able to select the following system page, corresponding to the highlighted area/equipment in the navigation tree:
2. Graphics: Using animated gifs or other graphical format suitable for display in a web browser, graphics shall include aerial building/campus views, color building floor-plans, equipment drawings of each individual piece of equipment with live variable statuses, active graphic setpoint controls, web content, and other valid HTML elements. The data on each graphic page shall automatically refresh at a rate defined by the operator.
3. Properties: Shall include graphic controls and text for the following: Locking or overriding BACnet objects, demand strategies, and any other valid data required for setup. Changes made to the properties pages shall require the operator to depress a 'accept/cancel' button.
4. Schedules: Shall be used to create, modify/edit and view schedules based on the systems geographical hierarchy (using the navigation tree) and in compliance with section 2.2.G
5. Events: Shall be used to view alarm event information geographically (using the navigation tree), acknowledge events, sort events by category, actions and verify reporting actions.
6. Trends: Shall be used to display associated trend and historical data, modify colors, date range, axis and scaling
7. Logic - Live Graphic Programs: Shall be used to display a 'live' graphic programs of the control algorithm for the mechanical/electrical system selected in the navigation tree. All control outputs and inputs shall displayed on the program giving real-time statuses for use in operator troubleshooting.

E. The following actions shall be accomplished by clicking appropriate buttons/menu's in the graphic window: Log In/Out, Print and Hide/Show Navigation Pane.

1. Color Graphics
  - a. The Web Browser GUI shall make extensive use of color in the graphic pane to communicate information related to setpoints and comfort. Animated gif's, active setpoint graphic controls and valid web content (like local weather forecast) shall be used to enhance usability:
  - b. Display Size: The GUI workstation software shall graphically display in 1024 by 768 pixels 24 bit True Color.
  - c. General Graphic: General area maps shall show locations of controlled buildings in relation to local landmarks.
  - d. Color Floor Plans: Floor plan graphics shall show heating and cooling zones throughout the buildings in a range of colors, which provide a visual display of temperature relative to their respective setpoints (see section 3.2 F below). The colors shall be updated dynamically as a zone's actual comfort condition changes in real-time. Locations of space sensors shall also be shown for each zone. The intent of the specification is to enable the operator to readily assess problems at a glance.
  - e. Mechanical Components: Mechanical system graphics shall show the type of mechanical system components serving any zone through the use of a pictorial representation of components. Selected I/O points being controlled or monitored for each piece of equipment shall be displayed with the appropriate engineering units. Animation shall be used for rotation or moving mechanical components to enhance usability.
  - f. Minimum System Color Graphics: Color graphics shall be selected and displayed via a web browser for the following:
    - 1) Each piece of equipment monitored or controlled including each terminal unit
    - 2) Each building
    - 3) Each floor and zone controlled
- F. Zone Setpoint Adjustments
  1. Color floor plans displayed via a web browser shall utilize a contiguous band of colors, each corresponding to actual zone temperatures relative to the desired heating and cooling setpoints. The ideal temperature shall be shown as a green color band. Temperatures slightly warmer than ideal shall be shown in yellow, and even warmer temperature band shall be shown in orange. Temperatures slightly cooler than ideal shall be light blue, and even cooler temperatures shall be shown as dark blue. All alarm colors shall be in red.
- G. Hierarchical Schedules
  1. Utilizing the Navigation Tree displayed in the web browser GUI, an operator (with password access) shall be able to define a Normal, Holiday or Override schedule for an individual piece of equipment or room, or choose to apply a hierarchical schedule to the entire system, site or floor area.
  2. All schedules that affect the system/area/equipment highlighted in the Navigation Tree shall be shown in a summary schedule table and graph.
- H. BACnet Schedules: Schedules shall comply with the BACnet standard, (Schedule Object, Calendar Object, Weekly Schedule property and Exception Schedule property) and shall allow events to be scheduled based on:
  1. Types of schedule shall be Normal, Holiday or Override



2. A specific date,
  3. A range of dates,
  4. Any combination of Month of Year (1-12, any), Week of Month (1-5, last, any), Day of Week (M-Sun, Any)
  5. Wildcard (example, allow combinations like second Tuesday of every month).
- I. **Schedule Categories:** The system shall allow operators to define and edit scheduling categories (different types of “things” to be scheduled; for example, lighting, HVAC occupancy, etc.). The categories shall include name, description, icon (to display in the hierarchy tree when icon option is selected) and type of value to be scheduled.
- J. **Schedule Groups:** In addition to hierarchical scheduling, operators shall be able to define functional Schedule Groups, comprised of an arbitrary group of areas/rooms/equipment scattered throughout the facility and site. For example, the operator shall be able to define an ‘individual tenant’ group – who may occupy different areas within a building or buildings. Schedules applied to the ‘tenant group’ shall automatically be downloaded to control modules affecting spaces occupied by the ‘tenant group’
- K. **Intelligent Scheduling:** The control system shall be intelligent enough to automatically turn on any supporting equipment needed to control the environment in an occupied space. If the operator schedules an individual room in a VAV system for occupancy, the control logic shall automatically turn on the VAV air handling unit, chiller, boiler, and/or any other equipment required to maintain the specified comfort and environmental conditions within the room.
- L. **Partial Day Exceptions:** Schedule events shall be able to accommodate a time range specified by the operator.
- M. **Schedule Summary Graph:** The schedule summary graph shall clearly show Normal versus Holiday versus Override Schedules, and the net operating schedule that results from all contributing schedules. Note: In case of priority conflict between schedules at the different geographic hierarchy, the schedule for the more detailed geographic level shall apply.
- N. **Schedule Distribution:** For reliability and performance, instead of maintaining a single schedule in a field device that writes over the network to notify other devices when a scheduled event occurs, field devices will only keep their part of the schedule locally. The BAS server software shall determine which nodes a hierarchical schedule applies to and will create/modify the necessary schedule objects in each field device as necessary.
- O. **Events ( & Alarms)**
1. Events and alarms associated with a specific system, area, or equipment selected in the Navigation Tree, shall be displayed in the Action Pane by selecting an ‘Events’ view. Events, alarms, and reporting actions shall have the following capabilities:
    - a. **Events View:** Each event shall display an Event Category (using a different icon for each event category), date/time of occurrence, current status, event report, and a URL link to the associated graphic for the selected system, area or equipment. The URL link shall indicate the system location, address and other pertinent information. An operator shall easily be able to sort events, edit event templates and categories, acknowledge or force a return to normal in the Events View as specified in this section.
    - b. **Event Categories:** The operator shall be able to create, edit or delete event categories such as HVAC, Maintenance, Fire, or Generator. An icon shall be

- associated with each Event category, enabling the operator to easily sort through multiple events displayed using a built-in filter.
- c. BACnet Event Templates: BACnet Event template shall define different types of alarms and their associated properties. As a minimum, properties shall include a reference name, verbose description, severity of event, acknowledgement requirements, high/low limit and out of range information.
  - d. Event Areas: Event Areas enable an operator to assign specific Event Categories to specific Event Reporting Actions.
  - e. Event Time/Date Stamp: All events shall be generated at the DDC control module level and comprise the Time/Date Stamp using the standalone control module time and date.
  - f. Event Configuration: Operators shall be able to define the type of events generated per BACnet object. A 'network' view of the Navigation Tree shall expose all BACnet objects and their respective Event Configuration. Configuration shall include assignment of event, alarm, type of Acknowledgement and notification for return to normal or fault status.
  - g. Event Summary Counter: The view of events in the Graphic Pane shall provide a numeric counter, indicating how many events are active (in alarm), require acknowledgement, and total number of events in the BAS Server database.
  - h. Persistent Data. The system shall allow for external systems to access the event instance data. Event data shall be stored and queried in the database in a relational manner. At a minimum, the fields to be stored in the database are:
    - Event Source
    - Event Generation Time
    - Acknowledge Required Flag
    - Delivery Priority
    - BACnet Event Type
    - Event Message Text
    - BACnet Event Parameter
    - Classification of Event
    - Event Acknowledgement Time
    - Return to Normal Time
    - Operator Comments
    - Who Acknowledged the Event
  - i. Event Auto-Deletion: Events that are acknowledged and closed shall be auto-deleted from the database and archived to a text file after an operator defined period.
  - j. Event Reporting Actions: Event Reporting Actions specified shall be automatically launched (under operator defined conditions) after an event is received by the BAS server software. Operators shall be able to fully define these Reporting Actions using the Navigation Tree and Graphic Pane in the web browser GUI. Reporting Actions shall be as follows:
    - 1) Print: Alarm/Event information shall be printed to the BAS server's PC or a networked printer.
    - 2) Email: Email shall be sent via any POP3-compatible e-mail server (most Internet Service Providers use POP3). Email messages may be copied to several email accounts.
2. **Note:** Email reporting action shall also be used to support alphanumeric paging services, where email servers support pagers.
- a. File Write: The ASCII File write reporting action shall enable the operator to append operator defined alarm information to any alarm through a text file. The alarm information that is written to the file shall be completely definable by the operator. The operator may enter text or attach other data point information (such

- as AHU discharge temperature and fan condition upon a high room temperature alarm).
  - b. Write Property: The write property reporting action updates a property value in a hardware module.
  - c. SNMP: The Simple Network Management Protocol (SNMP) reporting action sends an SNMP trap to a network in response to receiving an event.
  - d. Run External Program: The Run External Program reporting action launches specified program in response to an event.
3. Event Simulator: The web browser GUI user shall provide an Event Simulator to test assigned Reporting Actions. The operator shall have the option of using current time or scheduling a specific time to generate the Event. Utilizing the Navigation Tree and drop-down menus in the Graphic Pane, the operator shall be able to select the Event Type, Status, Notification, Priority, Message, and whether acknowledgement is required.
  4. External Injection of Events. The BAS server software shall provide a CORBA interface for external injection of events, allowing the system to receive/report events generated from external source other than the BAS system.

P. Trends

1. Trends shall conform to the BACnet Trend Log Object specification. The system shall be able to trend and display graphically all analog, digital or calculated points simultaneously. A trend log's properties shall be editable using the Navigation Tree and Graphic Pane.
2. Viewing Trends: The operator shall have the ability to view trends by using the Navigation Tree and selecting a Trends button in the Graphic Pane. The system shall allow y- and x-axis maximum ranges to be specified and shall be able to simultaneously graphically display multiple trends per graph.
3. Local Trends: Trend data shall be collected locally by Multi-Equipment/Single Equipment general-purpose controllers, and periodically uploaded to the BAS server if historical trending is enabled for the BACnet object. Trend data, including run time hours and start time date shall be retained in non-volatile module memory
4. Resolution. Sample intervals shall be as small as one (0.1) second. Each trended point will have the ability to be trended at a different trend interval. When multiple points are selected for display that have different trend intervals, the system will automatically scale the axis.
5. Dynamic Update. Trends shall be able to dynamically update at operator-defined intervals.
6. Zoom. It shall be possible to zoom-in on a particular section of a trend for more detailed examination.
7. Numeric Value Display. It shall be possible to pick any sample on a trend and have the numerical value displayed.

Q. Security Access

1. Systems that Security access from the web browser GUI to BAS server shall require a Login Name and Password. Access to different areas of the BAS system shall be defined in terms of Roles, Privileges and geographic area of responsibility as specified:
  - a. Roles: Roles shall reflect the actual roles of different types of operators. Each role shall comprise a set of easily understood English language' privileges. Roles shall be defined in terms of View, Edit and Function Privileges. Systems that use cryptic Boolean numbers to define system access are not acceptable.

- 1) View Privileges shall comprise Navigation, Network, and Configuration Trees, Operators, Roles and Privileges, Alarm/Event Template and Reporting Action.
  - 2) Edit Privileges shall comprise Setpoint, Tuning and Logic, Manual Override, and Point Assignment Parameters.
  - 3) Function Privileges shall comprise Alarm/Event Acknowledgement, Control Module Memory Download, Upload, Schedules, Schedule Groups, Manual Commands, Print, and Alarm/Event Maintenance.
2. Geographic Assignment of Roles: Roles shall be geographically assigned using a similar expandable/collapsible navigation tree.

## 2.3 GRAPHICAL PROGRAMMING

- A. The system software shall include a Graphic Programming Language (GPL) for all DDC control algorithms resident in standalone control modules. Any system that does not use a drag and drop method of graphical icon programming as described herein shall be unacceptable. GPL is a method used to create a sequence of operations by assembling graphic microblocks that represent each of the commands or functions necessary to complete a control sequence of operation. Microblocks represent common logical control devices used in conventional control systems, such as relays, switches, high signal selectors, etc., in addition to the more complex DDC and energy management strategies such as PID loops and optimum start. Each microblock shall be interactive and contain the programming necessary to execute the function of the device it represents.
- B. Graphic programming shall be performed while on screen and using a mouse; each microblock shall be selected from a microblock library and assembled with other microblocks necessary to complete the specified sequence. Microblocks are then interconnected on screen using graphic "wires," each forming a logical connection. Once assembled, each logical grouping of microblocks and their interconnecting wires then forms a graphic function block which may be used to control any piece of equipment with a similar point configuration and sequence of operation.
- C. Graphic Sequence
1. The clarity of the graphic sequence must be such that the operator has the ability to verify that system programming meets the specifications, without having to learn or interpret a manufacturer's unique programming language. The graphic programming must be self-documenting and provide the operator with an understandable and exact representation of each sequence of operation.
- D. Simulation
1. Full simulation capability shall be provided with the graphic programming. Operator shall be able to fully simulate the constructed control sequence prior to downloading into field control modules. Simulation capabilities shall include step-by-step, accelerated time, and operator defined simulation criteria like outside weather, demand, and communication status. Multiple graphic programs shall be simulated and displayed in split screens at the same time.
- E. GPL Capabilities
- The following is a minimum definition of the capabilities of the Graphic Programming software:

1. Function Block (FB): Shall be a collection of points, microblocks and wires which have been connected together for the specific purpose of controlling a piece of HVAC equipment or a single mechanical system.
2. Logical I/O: Input/Output points shall interface with the control modules in order to read various signals and/or values or to transmit signal or values to controlled devices.
3. BACnet Points: Shall be points that comply with the BACnet structure as defined in the BIBB's Addendum B1/B2, and the BACnet standard.
4. Microblocks: Shall be software devices that are represented graphically and may be connected together to perform a specified sequence. A library of microblocks shall be submitted with the control contractors bid.
5. Wires: Shall be graphical elements used to form logical connections between microblocks and between logical I/O. Different wire types shall be used depending on whether the signal they conduct is analog or digital.
6. Labels: Labels shall be similar to wires in that they are used to form logical connections between two points. Labels shall form a connection by reference instead of a visual connection; i.e. two points labeled 'A' on a drawing are logically connected even though there is no wire between them.
7. Parameter: A parameter shall be a value that may be tied to the input of a microblock.
8. Properties: Dialog boxes shall appear after a microblock has been inserted which has editable parameters associated with it. Default parameter dialog boxes shall contain various editable and non-editable fields and shall contain 'push buttons' for the purpose of selecting default parameter settings.
9. Icon: An icon shall be graphic representation of a software program. Each graphic microblock has an icon associated with it that graphically describes its function.
10. Menu-bar Icon: Shall be an icon that is displayed on the menu bar on the GPL screen, which represents its associated graphic microblock.
11. Live Graphical Programs: The Graphic Programming software must support a 'live' mode, where all input/output data, calculated data, and setpoints shall be displayed in a 'live' real-time mode. For each piece of HVAC equipment, the graphic program shall be complete and viewed on one screen. For example, a graphic program used for an Air Handling Unit shall not be broken down into separate components and require an operator to view only one component at any one time.

### PART 3 - PRODUCTS HARDWARE

#### 3.1 BAS SERVER HARDWARE

- A. Computer Configuration (One BAS server to be provided by control contractor under this project, unless there is an existing BAS Server furnished by this Contractor.)
  1. Central Server. The BAS Contractor shall provide a server configuration that includes the following components as a minimum:
    - Server Class computer ie: Dell Poweredge SC430
    - Operating system-Windows 2003 Server
    - Processor – 3GHZ P4, minimum 3 GB RAM
    - 80GB HDD, SCSI
    - CD – CDRW
    - 2 Button Mouse
    - 101 keyboard

- 17" Monitor
- SVGA Display card capable of 1024 X 768 resolution in true Color (32bit)
- 10/100 Ethernet NIC
- IE 6.0 or later
- Database engine – MS Access Db < 500MB, MSDE, MS SQL Server

B. Standard Client (Hardware Independent)

1. The thin-client browser interface shall be hardware agnostic, meaning it will support Microsoft browser (6.x versions) as well as most common server platforms (Windows NT, Sun Solaris and Linux). No special software, (active-x components or fat Java clients) shall be required to be installed on the PC's / PDA's used to access the BAS via a web browser. The following is the minimum suggested hardware requirements for a Windows/Intel client:
  - a. 700Mhz, PIII or higher CPU
  - b. 256Mb of RAM minimum
  - c. 20 gigabyte hard disk, SVGA Card with 1024 x 768, 24-bit True Color, 24X CD Rom Drive, 17" SVGA Color Monitor
  - d. Operating system for the computer operator workstation server shall be Microsoft Windows XP, 2000 or RedHat Linux 6.0 or Sun Solaris 7.0
  - e. Internet Explorer 6.x
  - f. Connection to the Intranet/Internet

No client hardware is required under this project if the BAS server can act as client in addition to the BAS server applications. Any owner/customer computers may act as client if the client computer has a 6.X browser and has connection capability to the DDC intranet/server.

3.2 NETWORK ROUTERS & BRIDGES

- A. The DDC/BAS controller network shall use BACnet as its native communication protocol. Network bridges and routers must be of a modular design to ensure reliability and system performance.
  1. BACnet Router
  2. The central system shall use the DDC/BAS Local Area Network (LAN) provided under this contract for communication. The communication between the central server and the controllers shall be BACnet/IP. A router shall be provided, as required, to bridge BACnet/IP and the data link used between the controllers (BACnet ARCNET and BACnet MS/TP). Proprietary networks and proprietary protocols are not acceptable.
    - a. Firmware Updates: The BACnet Router must utilize FLASH memory to allow firmware updates to be performed remotely.

3.3 STANDALONE CONTROLLERS

- A. General Purpose Multiple Application Controllers
  1. BACnet BIBBS: General Purpose Multiple Application controllers must use BACnet as the native communication protocol between controllers.
  2. Communication Speed: Controllers shall communicate at a minimum of 156 Kbps using ARCNET implemented over EIA-485 using an unshielded twisted pair at the Data Link Layer.

- B. General Specification: Each General Purpose Multiple Application Controller must be capable of standalone direct digital operation utilizing its own 32 bit processor, non-volatile flash memory, input/output, 12 bit A to D conversion, hardware clock/calendar and voltage transient and lightning protection devices. A separate co-processor shall be used for communications to the controller network. All non-volatile flash memory shall have a battery backup of at least five years. Firmware revisions to the module shall be made from the BAS server or remotely over the Intranet or Internet. Controllers that require component changes to implement firmware revisions are not acceptable.
- C. Point Expansion: The General Purpose Multiple Application Controllers shall be expandable to the specified I/O point requirements. Each controller shall accommodate multiple I/O Expander Modules via a designated expansion I/O bus port. These expander modules shall expand the total point capacity of each controller up to 192 points where specified. The controller, in conjunction with the expansion modules, shall act as one standalone controller.
- D. Point Programming: All point data, algorithms and application software within a controller shall be custom programmable from the operator workstation.
- E. Program Execution: Each General Purpose Multiple Application Controller shall execute application programs, calculations, and commands via a 32-bit microcomputer resident in the controller. All operating parameters for application programs residing in each controller shall be stored in read/writ able nonvolatile flash memory within the controller and will be able to upload/download to/from the BAS Server.
- F. Self-Test Diagnostics: Each controller shall include self-test diagnostics, enabling the controller to report malfunctions to the router and BAS Server.
- G. PID Loops: Each General Purpose Multiple Application Controller shall contain both software and firmware to perform full DDC Proportional, Integral, Derivative (PID) control loops and programs.
- H. Input-Output Processing:
  - 1. Digital Outputs shall be relays, 24 Volts AC or DC maximum, 3-amp maximum current. Each configured as normally open or normally closed using jumpers and either dry contact or bussed. Each output shall have a manual Hand-Off-Auto switch to allow for override and an LED to indicate the operating mode of the output. Triac outputs are unacceptable.
  - 2. Universal Inputs shall be Thermistor (BAPI Curve II) 10K Ohm at 77°F (25°C), 0-5VDC, 10K Ohm maximum source impedance, 0-20mA - 24 VDC loop power, 250 Ohm input impedance, dry contact - 0.5mA maximum current.
  - 3. Analog Output shall be electronic, voltage mode 0-10VDC or current mode 4-20mA.
- I. General Purpose Single Application Controllers
  - 1. BACnet BIBBS: The General Purpose Single Application Controllers must use BACnet as the native communication protocol between controllers.
  - 2. Communication Speed: Controllers shall communicate at a minimum of 156 Kbps using ARCNET implemented over EIA-485 using an unshielded twisted pair at the Data Link Layer.
  - 3. General Specification: General Purpose Single Application controllers must be capable of stand-alone DDC operation utilizing its own 32 bit processor, nonvolatile flash memory, input/output, 8 bit A to D conversion, hardware clock/calendar and voltage

transient protection devices. A separate co-processor shall be used for communications to the controller network. All RAM memory shall have a battery backup of at least five years. Firmware revisions to the module shall be made from the BAS server, or remote locations over the Internet. Controllers that require component changes to implement Firmware revisions are not acceptable.

4. Point Programming: All point data, algorithms, and application software within the controllers shall be custom programmable from the Operator Workstation.
5. Program Execution: Each General Purpose Single Application Controller shall execute application programs, calculations, and commands via a 32-bit microcomputer resident in the controller. All operating parameters for the application program residing in each controller shall be stored in read/writable nonvolatile flash memory within the controller and will be able to upload/download to/from the Operator Workstation.
6. Self-Test Diagnostics: Each controller shall include self-test diagnostics, enabling the controller to report malfunctions to the router and BAS Server input.
7. PID Loops: Each General Purpose Single Application Controller shall contain both software and firmware to perform full DDC PID control loops.
8. Rooftop Mounting: The General Purpose Single Application Controllers shall be capable of being mounted directly in or on rooftop AHU equipment.
9. Operating Temperature: The General Purpose Single Application Controllers shall be capable of proper operation in an ambient temperature environment of -20°F to +150°F (-28.9° to 65.6°C).
10. Input-Output Processing:
  - a. Digital Outputs shall be relays, 24 Volts AC or DC maximum, 3 amp maximum current. Each output shall have a manual Hand-Off-Auto switch to allow for override and an LED to indicate the operating mode of the output. **Triac outputs are unacceptable.**
  - b. Universal Inputs shall be Thermistor (BAPI Curve II) 10K Ohm at 77°F (25°C), 0-5VDC - 10K Ohm maximum source impedance, 0-20mA - 24 VDC loop power, 250 Ohm input impedance, Dry Contact - 0.5mA maximum current.
  - c. Analog Electronic Outputs shall be voltage mode 0-10VDC or current mode 4-20mA.
  - d. Enhanced Zone Sensor Input shall provide one thermistor input, one local setpoint adjustment, one timed local override switch, and an occupancy LED indicator.

### 3.4 FIELD HARDWARE/INSTRUMENTATION

#### A. Temperature Sensing Devices

1. Type & Accuracy. Temperature sensors shall be of the type and accuracy indicated for the application. Sensors shall have an accuracy rating within 1% of the intended use temperature range.
2. Outside Air Temperature Sensors. Outside air temperature sensors accuracy shall be within +1°F (0.5°C) in the range of -52°F to 152°F (-46.6°C to 66.6°C).
3. Room Temperature Sensors. Room temperature sensors shall have an accuracy of +0.36°F (0.25°C) in the range of 32°F to 96°F (0°C to 35.5°C).
4. Chilled Water and Condenser Water Sensors. Chilled water and condenser water sensors shall have an accuracy of +0.25°F (0.15°C) in their range of application.
5. Hot Water Temperature Sensors. Hot water temperature sensors shall have an accuracy of +0.75°F (0.3°C) over the range of their application.



- B. Pressure Instruments
  - 1. Differential Pressure and Pressure Sensors: Sensors shall have a 4-20 MA output proportional signal with provisions for field checking. Sensors shall withstand up to 150% of rated pressure, without damaging the device. Accuracy shall be within  $\pm 2\%$  of full scale. Sensors shall be manufactured by Leeds & Northrup, Setra, Robertshaw, Dwyer Instruments, Rosemont, or be approved equal.
  - 2. Pressure Switches: Pressure switches shall have a repetitive accuracy of  $\pm 2\%$  of range and withstand up to 150% of rated pressure. Sensors shall be diaphragm or bourdon tube design. Switch operation shall be adjustable over the operating pressure range. The switch shall have an application rated Form C, snap-acting, self-wiping contact of platinum alloy, silver alloy, or gold plating.
- C. Flow Switches
  - 1. Flow switches shall have a repetitive accuracy of  $\pm 1\%$  of their operating range. Switch actuation shall be adjustable over the operating flow range. Switches shall have snap-acting Form C contacts rated for the specific electrical application.
- D. Humidity Sensors
  - 1. Sensors shall have an accuracy of  $\pm 25\%$  over a range of 20% to 95% RH.
- E. Current Sensing Relays
  - 1. Relays shall monitor status of motor loads. Switch shall have self-wiping, snap-acting Form C contacts rated for the application. The setpoint of the contact operation shall be field adjustable.
- F. Output Relays
  - 1. Control relay contacts shall be rated for 150% of the loading application, with self-wiping, snap-acting Form C contacts, enclosed in dustproof enclosure. Relays shall have silver cadmium contacts with a minimum life span rating of one million operations. Relays shall be equipped with coil transient suppression devices.
- G. Solid State Relays
  - 1. Input/output isolation shall be greater than 10 billion ohms with a breakdown voltage of 15 V root mean square, or greater, at 60 Hz. The contact operating life shall be 10 million operations or greater. The ambient temperature range of SSRs shall be 20°F-140°F. Input impedance shall be greater than 500 ohms. Relays shall be rated for the application. Operating and release time shall be 10 milliseconds or less. Transient suppression shall be provided as an integral part of the relays.
- H. Valve and Damper Actuators
  - 1. Electronic Direct-Coupled: Electronic direct-coupled actuation shall be provided.
  - 2. Actuator Mounting: The actuator shall be direct-coupled over the shaft, enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The fastening clamp assemble shall be of a 'V' bolt design with associated 'V' shaped toothed cradle attaching to the shaft for maximum strength and eliminating slippage. Spring return actuators shall have a 'V' clamp assembly of sufficient size to be directly mounted to an integral jackshaft of up to 1.05 inches when the damper is constructed in this manner. Single bolt or screw type fasteners are not acceptable
  - 3. Electronic Overload Sensing: The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the entire rotation

- of the actuator. Mechanical end switches or magnetic clutch to deactivate the actuator at the end of rotation are not acceptable.
4. Power Failure/Safety Applications: For power failure/safety applications, an internal mechanical spring return mechanism shall be built into the actuator housing. Non-mechanical forms of fail-safe operation are not acceptable.
  5. Spring Return Actuators: All spring return actuators shall be capable of both clockwise or counterclockwise spring return operation by simply changing the mounting orientation.
  6. Proportional Actuators: Proportional actuators shall accept a 0 to 10VDC or 0 to 20mA control input and provide a 2 to 10VDC or 4 to 20mA operating range. An actuator capable of accepting a pulse width modulating control signal and providing full proportional operation of the damper is acceptable. All actuators shall provide a 2 to 10VDC position feedback signal.
  7. 24 Volts (AC/DC) actuators: All 24VAC/DC actuators shall operate on Class 2 wiring and shall not require more than 10VA for AC or more than 8 watts for DC applications. Actuators operating on 120VAC power shall not require more than 10VA. Actuators operating on 230VAC shall not require more than 11VA.
  8. Non-Spring Return Actuators: All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 in-lb torque shall have a manual crank for this purpose.
  9. Modulating Actuators: All modulating actuators shall have an external, built-in switch to allow reversing direction of rotation.
  10. Conduit Fitting & Pre-Wiring: Actuators shall be provided with a conduit fitting and a minimum 3ft electrical cable, and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.
  11. U.L. Listing: Actuators shall be Underwriters Laboratories Standard 873 listed and Canadian Standards Association Class 4813 02 certified as meeting correct safety requirements and recognized industry standards.
  12. Warranty: Actuators shall be designed for a minimum of 60,000 full stroke cycles at the actuator's rated torque and shall have a 2-year manufacturer's warranty, starting from the date of installation. Manufacturer shall be ISO9001 certified.

#### PART 4 - DDC SOFTWARE

##### 4.1 OVERVIEW

- A. The system shall continuously perform Direct Digital Control (DDC) functions at the local control module in a stand-alone mode. The operator shall be able to design and modify the control loops to meet the requirements of the system being operated. The operators shall use system provided displays for tuning of PID loops. These displays shall include the past three input variable values, the setpoint for the loop as well as the sample interval and the results of the proportional, integral and derivative effects on the final output.
- B. Minimum Function - Each control module shall perform the following functions:
  1. Identify and report alarm conditions
  2. Execute all application programs indicated on the I/O Summary table
  3. Execute DDC algorithms
  4. Trend and store data

C. Control Failure Mode

1. In the event of a control module failure, all points under its control shall be commanded to the failure mode as indicated on the I/O Summary Table. All DDC software shall reside in the respective control module.
  - a. Orderly Shutdown: Power failures shall cause the control module to go into an orderly shutdown with no loss of program memory.
  - b. Automatic Restart: Upon resumption of power, the control module shall automatically restart and print out the time and date of the power failure and restoration at the respective Workstation system.
  - c. Automatic Restart: The restart program shall automatically restart affected field equipment. The operator shall be able to define an automatic power up time delay for each piece of equipment under control.

PART 5 - APPLICATIONS SOFTWARE

5.1 GENERAL

The following applications software shall be provided for the purpose of optimizing energy consumption while maintaining occupant comfort:

A. Time of Day Scheduling (TOD) - The system shall be capable of the following scheduling features:

1. Schedule by Type. Scheduling by building, area, zone, groups of zones, individually controlled equipment and groups of individually controlled equipment. Each schedule shall provide beginning and ending dates and times (hours: minutes). A weekly repeating schedule, i.e. between 8:00 a.m. and 5:00 p.m., Monday through Friday shall constitute one schedule, not five.
2. Schedule in Advance. Dated schedules shall be entered up to nine (9) years in advance.
3. Self-Deleting. Schedules shall be self-deleting when effective dates have passed.
4. Leap Year. Leap years shall be adjusted automatically without operator intervention.

B. Optimum Start/Stop (OSS)/Optimum Enable/Disable (OED)

1. This application provides software to start and stop equipment on a sliding schedule based on the individual zone temperature and the heating/cooling capacity in °F/hour of the equipment serving that zone. The heating/cooling capacity value shall be operator adjustable. Temperature compensated peak demand limiting shall remain in effect during morning start up to avoid setting a demand peak.

C. Source Temperature Optimization (STO)

1. The system shall automatically perform source optimization for all air handling units, chillers and boilers in response to the needs of other downstream pieces of equipment, by increasing or decreasing supply temperature setpoints, i.e. chilled water, discharge air, etc. using owner defined parameters. In addition to optimization, the STO capability shall also provide for starting and stopping primary mechanical equipment based on zone occupancy and/or zone load conditions.

D. Demand Limiting (DL) - Temperature Compensated

1. The DL application shall be programmable for a minimum of six separate time of day KW demand billing rate periods. The system shall be capable of measuring electrical usage from multiple meters serving one building and each piece of equipment being

controlled on the LAN shall be programmable to respond to the peak demand information from its respective meter.

- a. Sliding Window: The demand control function shall utilize a sliding window method with the operator being able to establish the kilowatt threshold for a minimum of three adjustable demand levels. The sliding window interval shall be operator selectable in increments of one minute, up to 60 minutes. Systems that incorporate rotating shed tables will not be acceptable.
- b. Setpoints for Defined Demand Level: The operator shall have the capability to set the individual equipment temperature setpoints for each operator defined demand level. Equipment shall not be shed if these reset setpoints are not satisfied; rather the setpoint shall be revised for the different established demand levels. The system shall have failed meter protection, such that when a KW pulse is not received from the utility within an operator adjustable time period, an alarm will be generated. The system software will automatically default to a predetermined fail-safe shed level.
- c. Information Archiving: The system shall have the ability to archive demand and usage information for use at a later time. System shall permit the operator access to this information on a current day, month to date and a year to date basis.

E. Day/Night Setback (DNS)

1. The system shall allow the space temperature to drift down [up] within a preset [adjustable] unoccupied temperature range. The heating [cooling] shall be activated upon reaching either end of the DNS range and shall remain activated until the space temperature returns to the DNS range. (Occupied Set Point should be 73°F Cooling with a Night Setback to 85°F. Occupied Set Point should be 72°F Heating with a Night Setback to 65°F. – This is an initial setting which should be coordinated with the Owner prior to the Owner taking possession of the building.)

F. Timed Local Override (TLO)

1. The system shall have TLO input points that permit the occupants to request an override of equipment that has been scheduled OFF. The system shall turn the equipment ON upon receiving a request from the local input device. Local input devices shall be push button (momentary contact), wind-up timer, or ON/OFF switches as detailed in the I/O summary.

G. Space Temperature Control (STC)

1. There shall be two space temperature setpoints, one for cooling and one for heating, separated by a dead band. Only one of the two setpoints shall be operative at any time. The cooling setpoint is operative if the actual space temperature has more recently been equal to or greater than the cooling setpoint. The heating setpoint is operative if the actual space temperature has more recently been equal to or less than the heating setpoint. There are two modes of operation for the setpoints, one for the occupied mode (example: heating = 72°F or 22°C, cooling = 76°F or 24.4°C) and one for the unoccupied mode (example: heating = 55°F or 12.7°C, cooling = 90°F or 32°C).
  - a. Schedule: The occupied/unoccupied modes may be scheduled by time, date, or day of week.
  - b. Color Code: One of seven colors shall be generated to represent the comfort conditions in the space, and shall be displayed graphically at the operator station.
    - 1) If the actual space temperature is in the dead band between the heating setpoint and the cooling setpoint, the color displayed shall be green for the

- occupied mode, representing ideal comfort conditions. If in the unoccupied mode, the color displayed shall be gray representing 'after-hours' conditions.
- 2) If the space temperature rises above the cooling setpoint, the color shall change to yellow. Upon further rise beyond the cooling setpoint plus an offset, the color shall change to orange. Upon further rise beyond the cooling setpoint plus the yellow band offset, plus the orange band offset, the color shall change to red indicating unacceptable high temperature conditions. At this point an alarm shall be generated to notify the operator.
  - 3) When space temperature falls below the heating setpoint, the color shall change to light blue. Upon further temperature decrease below the heating setpoint minus an offset, the color shall change to dark blue. Upon further space temperature decrease below the heating setpoint minus the light blue band offset minus the dark blue band offset the color shall change to red indicating unacceptable low temperature conditions. At this point an alarm shall be generated to notify the operator.
- c. Operator Definable: All setpoints and offsets shall be operator definable. When in the occupied mode, start-up mode, or when heating or cooling during the night setback unoccupied mode, a request shall be sent over the network to other equipment in the HVAC chain, such as to an AHU fan that serves the space, to run for ventilation. The operator shall be able to disable this request function if desired.
  - d. Additional Cooling: When comfort conditions are warmer than ideal, indicated by the colors yellow, orange, and high temperature red, a request for additional cooling shall be sent over the network to other cooling equipment in the HVAC chain, such as a chiller. This information is to be used for optimization of equipment in the HVAC chain. The operator shall be able to disable this function if desired.
  - e. Additional Heating: When comfort conditions are cooler than ideal; indicated by the colors light blue, dark blue, and low temperature red; a request for additional heating shall be sent over the network to other heating equipment in the HVAC chain, such as a boiler. This information is to be used for optimization of equipment in the HVAC chain. The operator shall be able to disable this function if desired.
  - f. Cooling/Heating Setpoints: The cooling [and heating] setpoints may be increased [decreased] under demand control conditions to reduce the cooling (heating) load on the building during the demand control period. Up to three levels of demand control strategy shall be provided. The operator may predefine the amount of setpoint increase [decrease] for each of the three levels. Each space temperature sensor in the building may be programmed independently.
  - g. Optimum Start: An optimum start-up program transitions from the unoccupied setpoints to the occupied setpoints. The optimum start-up algorithm considers the rate of space temperature rise for heating and the rate of space temperature fall for cooling under nominal outside temperature conditions; it also considers the outside temperature; and the heat loss and gain coefficients of the space envelope (AI: Space Temperature).
  - h. PID Loop: A PID control loop, comparing the actual space temperature to its setpoint, shall modulate the dampers [and heating coil valve or heating stages in sequence] to achieve the setpoint target.

## PART 6 - EXECUTION

### 6.1 PREPARATION

- A. Protection of Persons and Property
  - 1. Safety Precautions and Programs. The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work.
  - 2. Safety of Persons and Property. The Contractor shall take all reasonable precautions and provide all reasonable protection to prevent damage, injury or loss to:
    - a. All employees on the installation sites and all other persons who may be affected.
    - b. All work, materials, and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody, or control of the Contractor or any Subcontractor or Sub-subcontractor.
    - c. Other property at the site or adjacent thereto. The Contractor shall comply with all applicable laws, ordinances, rules, regulations and lawful orders or any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. It shall erect and maintain, as required by existing conditions and progress of the work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.

### 6.2 HARDWARE INSTALLATION

- A. Utility Company Equipment - Owner shall arrange installation of electric billing meters with demand signal pulses, as indicated on the I/O Summary Table.
- B. Wiring
  - 1. The Contractor shall install wires for the room temperature sensors (from sensor to the appropriate control module).
  - 2. The Contractor shall install all sensing devices and the wiring to modules.
  - 3. The Contractor shall install all control and monitoring wiring in Mechanical Room.
  - 4. Low voltage wire shall be not less than 18 AWG. All line voltage wire shall be THHN/TFFN, 600 volt rated.
  - 5. All exposed wiring in occupied space shall be run in conduit (EMT). Concealed wiring may be installed using plenum rated cable, neatly supported using J hooks.

### 6.3 SMOKE DETECTORS

- A. Smoke detectors approved for duct installation shall be provided by Division 16 for all air systems of 2000 cfm capacity or above or as indicated on the drawings, to automatically shut down the supply fan and close all smoke dampers (as required). Each detector shall have an integral relay and be capable of operating a remote. All wiring shall be in conduit.
- B. Smoke detectors shall be furnished by Division 16000 and installed under Division 15000. All wiring between detector and fire alarm system shall be provided and installed under Division

16000. All wiring between detector and unit and between detector and BAS shall be provided and installed under Division 15000. All wiring shall be in conduit.

#### 6.4 FIRE ALARM INTERLOCK, EQUIPMENT INTERLOCK AND EMERGENCY

- A. Provide relays and interlock wiring in the starting circuits of all air moving equipment to stop operation when the building fire alarm system is activated. Contacts shall be installed in the central fire alarm panel for this signal; coordinate with fire alarm panel furnished under Division 16.
- B. Additionally, provide on the face of the Central Control Panel and at a remote alarm panel located in the Administration area, an "Emergency Ventilation" switch. Switch shall be wired so that all air moving equipment will immediately shut down when switch is depressed. All outdoor air intakes within the building shall re-position to fully closed.
- C. Provide all interlock wiring between air-conditioning units, fans, dampers, space sensors, clocks, and other related equipment as necessary to achieve the specified operating sequence.

#### 6.5 RELAYS

- A. Provide relays in power wiring to stop and start exhaust fans, domestic water heaters, pumps, etc., as required. Relays shall be of the voltage and ampere rating required for the load served and shall have NEMA-1 enclosure.

#### 6.6 DAMPER ACTUATORS

- A. Damper actuators shall be 24 volt proportional motor operators. Contacts shall be provided for each actuator, which accepts a 24 volt signal for the smoke detector to close the contact. Step down transformer shall be provided and installed by Div 15 to handle 120 volt power.

#### 6.7 VALVES

- A. Control valves shall be electric operated. Actuators shall be mounted vertically above piping served or horizontally, no lower than the center line of the piping. Surrounding piping and equipment shall be located and valve location in piping shall be such that a minimum service clearance of 6" (or greater as required by the manufacturer's recommendations) is provided between the top of the valve actuator and the obstruction to facilitate maintenance and removal of actuator.

#### 6.8 TELEPHONE LINES

- A. The Owner shall provide a voice grade telephone line.

6.9 DEMAND METERING

- A. An energy pulse signal shall be provided at the building metering point by the utility company. The Contractor shall extend wiring in conduit from the meter location to the control module for demand meter input signal.

6.10 CONTROL PANELS

- A. Furnish formed sheet metal control panels as required with locking door and hinges. All necessary relays, switches and peripheral devices shall be located inside panels. All electric devices shall be connected to numbered terminal strips. All control panels shall be centrally located. The main control panel shall be provided with space for a data port. Provide a temporary modem in the main control panel located in the main mechanical room.
- B. Main communication panel shall be located in MDF off the Center Corridor.
- C. Central control panel shall be powered from the emergency generator.

6.11 CONTROL WIRING AND CONDUIT

- A. All control wiring shall be run in metal conduit with outlet boxes and fitting equal to those specified under Division 16000. Line voltage wiring shall be no smaller than 14 gauge, 600 volt wire. All conduit shall be located in wall cavity or above ceilings. Wall surface mounted conduit shall be prohibited. Plenum rated cable routed exposed shall be prohibited.
- B. Conduit shall be run between the main control panel in the mechanical room and the main communication panel data connection located in MDF room off the Main Corridor.
- C. Conduit shall be provided in the main control panel cabinet between the exterior cabinet and internal main controller.

PART 7 - SEQUENCE OF OPERATION

- 7.1 Refer to I/O summary for control point description.

7.2 SINGLE ZONE ROOF TOP UNITS WITH DEHUMIDIFICATION CYCLE

- A. Control module shall be provided for each roof-top unit to control the fan, compressor, gas heat and hot gas reheat in the unit. A wall mounted temperature/humidity sensor with local override button located in the space shall provide an analog input signal to the control module.
- B. Each roof-top unit shall be programmed to start and stop according to the day/night schedule provided by the Owner. In addition, the classroom areas are supplied with motion detectors installed under the Electrical division of work. Motion detectors contain an auxiliary set of contacts for use by the BAS in setback of space conditions during unoccupied periods of the day schedule. Length of time delay and setback shall be fully adjustable, and independent of the night setback control.



- C. The unit fan shall run continuously in the day cycle.
- D. On a rise in space temperature above the cooling set point, the compressor shall start. Provide multiple stage control for units with multiple steps of capacity. Coordinate with mechanical contractor and actual purchased equipment.
- E. On a rise in space humidity above the relative humidity set point and no rise in space temperature above the cooling set point, the compressor(s) shall start and the hot gas heat coil shall be activated.
- F. On a drop in space temperature below the heating set point, the electric heater shall start. Electric heaters have multiple stages. Coordinate stages with the mechanical contractor and actual equipment purchased.
- G. In the night cycle the unit fan shall be off. On a drop in space temperature below the night setting of 55 degrees F., the fan and the gas heat shall start.
- H. Duct mounted smoke detectors, furnished as part of the fire alarm system and installed in the supply duct of each unit, shall shut down the respective roof-top unit on detection of smoke.
- I. Provide fan status monitoring for the supply fan.
- J. Unit shall be provided with an enthalpy economizer cycle. Provide a CO2 sensor located within space for demand control ventilation. The outside damper shall modulated between the minimum ventilation position and maximum ventilation position as the CO2 level increases within the space from a predetermined/adjustable setpoint.
- K. Central control system shall override the outdoor air damper actuator and shall fully close the dampers when the “emergency hazardous conditions mode” is activated from the administration office.

### 7.3 RANGE HOOD FANS

- A. Range hood exhaust fan and make-up air fans shall be started by an on-off switch located in a wall mounted control panel adjacent to the range hood.

### 7.4 DOMESTIC HOT WATER HEATING

- A. Water heaters with hot water circulating pumps shall have their pump started and stopped according to a day/night schedule provided by Owner and by the demand control program.
- B. An immersion temperature sensor shall be located in the hot water supply piping of all water heaters with circulating pumps. The immersion temperature sensor shall be located in the common hot water supply piping header for the kitchen (Water heaters in the MECH) water heaters. The sensor shall be located a maximum of 10’ from the water heater discharge and in the room the water heater is located. The sensor shall be in an accessible location. These water heaters shall be provided with an analog input signal to the control module to provide temperature indication only. The size and length of the immersion sensor shall be coordinated

with the Plumbing contractor for well size requirements. **Strap on type temperature sensors are not acceptable.**

#### 7.5 EXHAUST FANS

- A. See fan schedule for type of control for each fan. Fans noted to be controlled through the building energy management system shall be interlocked with control modules, set to operate by a schedule provided by the Owner. Central control system shall terminate operation of all fans under its control when the “hazardous conditions mode” is activated from the administration office.

#### 7.6 ELECTRIC CEILING AND WALL MOUNTED HEATER

- A. Units shall be controlled by its internal thermostat, but shall be enabled / disabled based on the Owner’s occupied/un-occupied schedule.

#### 7.7 DUCTLESS SPLIT SYSTEMS

- A. Control module shall be provided for each split system to control the evaporator fan, and remote condensing unit or outdoor heat pump unit. A wall mounted temperature sensor located in the space shall provide an analog input signal to the control module.
- B. Each split system shall be programmed to start and stop according to the day/night schedule provided by the Owner.
- C. Each split system shall be capable of remote start and stop (enable/disable).
- D. The unit evaporator fan shall run continuously in the day cycle.
- E. On a rise in space temperature above the cooling set point, the compressor shall start. Provide two stage control for units with two steps of capacity.
- F. On a drop in space temperature below the heating set point, heat pump unit compressors shall be on and the reversing valve shall be engaged.
- G. In the night cycle the unit fan shall be off. On a drop in space temperature below the night setting of 55 degrees F., the fan shall start and the heating cycle shall be on.
- H. Provide fan status monitoring for the supply fan.
- I. Ductless split systems serving data rooms shall be monitored by a separate temperature sensor, independent of the controlling unit space sensor.

#### 7.8 EMERGENCY OPERATIONS

- A. Main communication control panel (located in MDF Room) shall be connected to the emergency generator. This will be the only panel with emergency power. Refer to Division 16 drawings for exact panel location.

- B. Provide 2 programmable points for a switch on the face of the central control panel. The switch shall be utilized to initiate the termination of all air moving equipment. Provide a list of all air moving equipment for Owner review.
- C. Additionally, provide on the face of the Central Control Panel and at a remote alarm panel located in the Administration area, an "Emergency Ventilation" switch. Switch shall be wired so that all air moving equipment including exhaust fans will immediately shut down when switch is depressed. All outside air intake dampers shall close.

#### 7.9 PROJECT START-UP

- A. Controls Contractor shall make out start-up cards for all unit and system controllers, as per start up card furnished below, and shall furnish same before Final Completion of project.
- B. Final submittal of start-up cards shall be bound in a three ring binder, collated with unit start-up cards by unit number. Start-up cards shall be in ascending order by unit number with the unit start-up card located before the programming start-up card. Different types of equipment (fan-coil units, rooftop units, etc.) shall be separated with clearly labeled tabs.

#### 7.10 LIGHTING CONTROL

- A. The requirements of the energy management system shall be expanded to include lighting control functions. Individual lighting control contactors shall be provided in remote portions of the building, and shall include multiple output contactors, each rated for a minimum of 5 amps each at 110 volts. Install control contacts in individual panels at each location. Individual contactors shall receive inputs from central control over the network, and shall convert these inputs to 110 volt outputs. Each location will be provided with a 110 volt, 20 amp service from the electrical division of work. Incoming 110 volt service shall be sub-divided to each output contactor. A control module at each location shall cycle the 110 v, contactors in accordance with programming from the central site. The individual panel shall include a transformer for 24 volt service as needed to accomplish the internal panel operations. Refer to electrical design documents for quantity and location of lighting contactors.
- B. Scheduling, or on-off operation of each 110 volt output contactor shall be provided by programming from the EMS central site. The central site shall also be interlocked with the Owner's security system, and fire alarm systems for this project. The Owner's security system will be utilized for controlling access to the occupied lighting functions of the facility. An additional 10 inputs from the security system is estimated.
- C. System design is based on lighting contactors and building control sub-panels, all located throughout the building. A lighting control controller shall be installed at each electrical room, which has lighting panels. Coordinate with electrical for exact number and locations of lighting panels to installation of control panels.
- D. The building control panel located in the Control Room is the only panel provided with emergency power from the generator.
- E. The controls contractor is responsible for running all control wiring conduit. Refer to electrical specifications.

- F. Control of the exterior lighting shall also be included as a part of the system. Refer to the electrical drawing for connection points. Exterior lights shall be scheduled by the building automation system. A secondary photocell shall override the lighting schedule and activate the exterior lighting if the ambient lighting levels fall below a preset minimum, and the system is scheduled off.

#### 7.11 FIRE ALARM INTERLOCK

- A. Contractor shall interlock with the central fire alarm control panel with wiring to contacts, a controller, and programming. Control points for interface with the fire alarm control panel shall be provided for the following:
  - Monitor
  - Alarm – An alarm signal from the fire alarm shall shut-down the HVAC
  - Trouble
  - Supervision

#### 7.12 EMERGENCY GENERATOR INTERLOCK & POWER MONITORING

- A. Contractor shall interlock with the emergency generator controller with wiring to contacts, a controller, and programming. Control points for interface with the emergency generator control panel shall be provided for the following:
  - Alarm
  - Run
  - Transfer Switch – Switch from non-emergency to emergency and back.
- B. The incoming power source has phasing monitoring provided by the electrical division of work. The BAS shall interface with this equipment to transmit alarm conditions into the overall building monitoring. A minimum of 3 main panel locations shall be monitored. Refer to the electrical design documents for locations.

#### 7.13 TRAP PRIMER CONTROL

- A. Trap primers shall be activated on an operator assignable schedule for an adjustable on time. The EMS controller shall accumulate the total trap primer run times. Provide manual overrides for all trap primer distribution units and single trap primer valves. The overrides shall be located at trap primer distribution units and single trap primer valves. The units serving the hub drains at the mechanical platform shall be accessible from the mechanical platform. The initial setting shall be requested from the Owner and programmed before the project is turned over to the Owner. Coordinate exact number and locations of trap primers with the Plumbing Plans.

#### 7.14 Carbon Monoxide Sensors and Monitoring

- A. A carbon monoxide sensor shall be provided and installed in the ceiling at the first air device of all gas-fired heating systems, and in all gas-fired water heater rooms. The sensor shall monitor the discharge air and space conditions. If carbon monoxide is sensed a notification and alarm shall be sent to the central site computer.

7.15 ROOF ACCESS

- A. Provide door switches at all roof access doors and hatches. Provide an alarm signal when a door or hatch is opened.

7.16 SYSTEM ACCEPTANCE

- A. Reference section 01770 for general requirements.

7.17 CLOSEOUT DOCUMENTATION

- A. Properly completed start-up forms, including the form shown below, documenting proper field quality control and demonstration as outlined in section 1.5 above, shall be received by the Owner prior to granting of substantial completion.

7.18

**CONTROL CONTRACTOR'S PROGRAMMING CHECKLIST**  
**Dade County Schools**  
**ALL INFORMATION IS TO BE TYPED**

**School Name**

**Unit No.**

**EMS Address**

Point Editing (w/correct definition (to include unit number and room number), minimum on/off times, alarms limits, heating & cooling limits, etc.)

Critical Alarms

Event Log Setup

Zone Setpoints

Time of Day Schedules

Freeze Protection

Demand Limiting

Duty Cycle

Freezer Equation

Cooler Equation

**GRAPHICS:**

Remote Point Status Listings

Floor Plan - Location & Label

Equation Flow Charts (if applicable)

END OF SECTION 15900

## **SECTION 15950 - TESTING, ADJUSTING, AND BALANCING**

### **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 SCOPE OF WORK**

- A. Test and Balance Agency will be retained by the HVAC Contractor.
- B. The contractor responsible for installing the HVAC equipment shall perform preliminary testing and balancing of all equipment including fan rotation, pump rotation, control valve operation, start-up on all equipment, etc., as required to assist the test and balance contractor.
- C. The Test & Balance Agency in conjunction with the control sub-contractor shall check out each system for control function through the entire sequences specified. All device set points, damper positions, actuator travel, relay actions, etc. shall be verified for proper operation.
- D. Contractor shall manipulate the control devices thru the sequences specified, or as required to achieve conditions necessary for the complete testing and balancing of the installed systems.
- E. Coordinate the test and balance to provide sufficient time before final completion date so that tests and balancing can be accomplished. Testing and balancing shall be accomplished prior to installation of security ceilings, or other types of closures.
- F. Provide immediate labor and tools to make corrections, when required, without undue delay.
- G. The Contractor shall put all heating, ventilating and air conditioning systems and equipment into full operation and shall continue the operation of same during each working day of testing and balancing.
- H. Testing and balancing personnel shall be kept informed of any major changes made to the system(s) during construction and shall be provided with a complete set of as-built drawings.

#### **1.3 CONTRACT DOCUMENTS**

- A. Within 60 days of acceptance of contract, the contractor shall provide the designated TAB Agency with a complete set of Construction Documents, Equipment Specifications, and Equipment Submittals including all pertinent addenda items.
- B. The TAB Agency shall be provided by the General Contractor or Mechanical Contractor the following items when issued or received:
  - 1. Copies of all Addenda

2. Change Orders
3. Equipment Manufacturer's Submittal Data
4. Mechanical Shop Drawings
5. Temperature Control Shop Drawing
6. Project Schedule

#### 1.4 NOTIFICATION AND SCHEDULING

- A. Before testing and balancing commences, the TAB Agency shall receive notification in writing from the Mechanical Contractor stating that the HVAC system(s) is operational, complete and ready for balancing. A complete system means more than just physical installation. The Mechanical Contractor shall certify that all prime movers: fans, pumps, refrigerant machines, boilers, etc., are installed in good working order, and that full load performance has been preliminarily tested. Mechanical Contractor shall certify in writing that all equipment has been checked, started, adjusted and operated per the manufacturer's recommendations. Mechanical Contractor shall include copies of factory start-up reports for specified equipment.
- B. The schedule for testing and balancing of the HVAC systems shall be established once notification has been received by the TAB Agency.

#### 1.5 COORDINATION WITH OTHER TRADES

- A. The Contractor, Mechanical Contractor, Temperature Control Subcontractor and the supplier of the HVAC equipment shall cooperate with the TAB Agency to provide all necessary data on design and proper application of the system components. In addition, they shall furnish all labor and materials required to eliminate any system deficiencies.
- B. The TAB Agency shall coordinate the location and type of all taps, valves, sensors, damper, etc., as required for proper system testing and balancing with the Mechanical Contractor prior to beginning work.
- C. The TAB Agency shall visit project before beginning initial testing and balancing to inspect installation of HVAC system, location and testing of all testing taps, etc., and provide a written report of all deficiencies to the Mechanical Contractor, Mechanical Engineer and Architect.
- D. To bring the HVAC system(s) into a state of readiness for testing, adjusting and balancing, the installing Mechanical Contractor shall perform the following:

### PART 2 - PRODUCTS

#### 2.1 TESTING AND BALANCING INSTRUMENTS

- A. Instruments used for final testing and balancing will be provided by the designated TAB agency. All final test analysis reports will include a letter of certification listing instrumentation used and last date of calibration.
- B. Contractor shall provide all additional instruments, devices, etc. as required for the initial start-up and balancing of the systems.



## PART 3 - EXECUTION

### 3.1 GENERAL

- A. The contractor shall provide the following conditions prior to the services of the designated TAB agency:

1. AIR SYSTEMS

- a. Ensure that all splitters, extractors, volume, smoke and fire dampers are properly located and functional. Dampers serving the requirements of smoke, outside air, return air and exhaust air shall provide tight closure and full opening, with smooth, free operation.
- b. Verify that all supply, return, exhaust and transfer grilles, registers, diffusers are installed properly and free of objectionable noise.
- c. Verify that all fans are operating and free of vibration. All fans and drives shall be checked for proper rotation and belt tension.
- d. Install clean filters in all units prior to testing.
- e. Make all necessary changes as required by the TAB Agency, at no additional charge to the owner.

2. WATER CIRCULATION SYSTEM

- a. Check all pumps for proper alignment and rotation.
- b. Ensure that all water systems have been properly cleaned, strainers removed, cleaned, are full and free of air, that expansion tanks have been properly charged and that air vents have been installed in all high points in piping systems.

3. TEMPERATURE CONTROLS

- a. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water resets, and fire and smoke dampers.
- b. Verify that all sensors are calibrated and set for design operating conditions.
- c. Make available to the TAB Agency any needed unique instruments for setting of D.D.C. controls.
- d. Provide assistance and instruction to the TAB Agency in the proper use and settings of control components.

- B. The contractor shall provide assistance and support services to the designated TAB agency as required to perform the scope or work listed below:

1. PRECONSTRUCTION PLAN CHECK AND REVIEW

- a. The TAB Agency shall perform a preconstruction review of the contract documents and equipment submittals for their effect on the testing and balancing process. Review shall include location and type of volume dampers, air valves, balancing valves, flow metering stations, automatic control valves, pressure sensors, sheet metal and piping shop drawings.
- b. Submit any recommendations for enhancements or changes to the system within 30 days of document review.

2. ON-GOING JOB SITE INSPECTIONS

- a. During construction, the test and balance agency shall inspect the installation of pipe systems, sheet metal work, temperature controls and other component parts of the HVAC systems. Inspections shall be performed when 60% of the piping and or sheet work is installed and again when 90% of the total HVAC system is installed and prior to insulation of piping systems.

- b. The balancing agency shall submit a written report of each inspection to the owner's representative, the Mechanical Engineer and the contractor responsible for correcting any noted deficiencies.
  - c. Inspections shall check for all necessary balancing hardware (dampers, flow meters, valves, pressure taps, thermometer wells, etc) to determine if they are installed properly and readily accessible.
  - d. Identify and evaluate any variations from system design.
  - e. Identify and report possible restrictions in systems (closed dampers, long runs of flexible ductwork, poorly designed or connected duct fittings, excessive piping losses, etc.).
3. RECORD & REPORT DATA
- a. The Test and Balance report shall be complete with logs, data and records as required herein. Air and water flow quantities shall be balanced within 5% of the values specified in the contract documents. All logs, data and records shall be typed on white bond paper and bound. The report shall be certified accurate and complete by the Testing and Balancing Agency's registered Professional Engineer.
  - b. Six copies of the Certified Test and Balance Reports shall be submitted to the Architect for review and acceptance.
  - c. The report shall include, but not be limited to, the following data.
    - 1) Project Number
    - 2) Contract Number
    - 3) Project Title
    - 4) Project Location
    - 5) Project Architect
    - 6) Project Mechanical Engineer
    - 7) General Contractor
    - 8) Mechanical Contractor
    - 9) Date tests were preformed
    - 10) Certification
    - 11) General discussion of system(s) and any abnormalities or problems encountered

<u>Test and Report Forms</u>	<u>AABC Form No.</u>
Cover Sheet	89010
Instrument List	89020
Air Moving Equipment Test Sheet	89030
Exhaust Fan Data Sheet	89031
Return/Outside Air Data	89033
Air Distribution Test Sheet	89040
Temperature Readings	89043
Electric Heater Report	89050
Pump Data Sheet	89060
Water Balance Data	89061
Cooling Tower Data	89070
Heat Exchanger	89090
Cooling Coil Data	89101
Combustion Test	89600
Other Forms as Required	----

- d. The following items shall be tested, balanced, adjusted as required for proper system operation:
    - Adjust all diffusers, grilles and registers to minimize drafts in all areas
    - Emergency Gas Shut-off Valve/Shunt-Trip Devices at Cooking Batteries
    - Energy Recovery Units
    - Rooftop Units
    - Supply and Return Air Grilles and Diffusers
    - Supply & Exhaust Fans
    - Dishwasher Exhaust System
    - Kitchen Hoods
    - Fan-coil and Air-handling Units
    - Pumps
    - Boilers
    - Wall hung HVAC Units
    - Unit Heaters
    - Electric Heaters
    - Ductless Split System
    - Variable refrigerant flow fan-coils
  - e. Overall system(s) and installation for compliance with contract drawings and specifications.
4. CONTROL SYSTEM VERIFICATION
- a. Verify that all control devices are properly connected
  - b. Verify that all dampers, valves and other controlled devices are operated by the intended controller.
  - c. Verify that all dampers and valves are in the position indicating by the controller (open, closed and modulating).
  - d. Verify the integrity of valves and dampers in terms of tightness of close-off and full-open positions.
  - e. Check that all valves are properly installed in the piping system in relation to direction of flow and location.
  - f. Check the calibration of all controllers
  - g. Check the locations of all sensors to determine whether their position will allow them sense only the intended temperatures or pressures. Control contractor shall relocate as deemed necessary by the TAB Agency.
  - h. Check locations of all sensors, thermostats, etc., for potential erratic operation from outside influences such as sunlight, drafts, or cold walls.
  - i. Verify the operation of all interlocked systems.
  - j. Verify that all controller set points meet the design intent.
  - k. Perform all system verification to assure the safety of the system and its components.
5. SYSTEM PERFORMANCE VERIFICATION
- a. a. At the time of final inspection, the Test and Balance Contractor shall recheck, in the presence of the owner's representative random selections of data, air and hydronic quantities and other items recorded in the Certified Report.
  - b. Points and areas for recheck will be selected by the Owner's representative and shall not exceed 25 percent of the total number tabulated in the Certified Report.
  - c. If random tests indicate a measured deviation in air or hydronic flow of ten percent or more from that recorded in the Certified Report, the complete report is rejected, all systems shall be readjusted and tested, new data recorded, new Certified Reports prepared and submitted, and new inspection tests made, all at no additional cost to the owner.

- d. Following system verification of the Certified Report by the Owner's Representative, the settings of all valves, splitter dampers, and other devices shall be permanently marked by the Test and Balance Agency, so that adjustment can be restored if disturbed at any time. Devices shall not be marked until after system verification.
- 6. OPPOSITE SEASON TEST
  - a. Testing and Balancing Agency shall perform an inspection of the HVAC system during the opposite season from that in which the initial adjustments were made. The TAB Agency shall make any necessary modifications to the initial adjustments to produce optimum system operation.
  - b. The T & B Agency shall resubmit six (6) copies of the complete test and balance reports to the Engineer for approval prior to final acceptance of the project.
- 7. ADDITIONAL TESTS
  - a. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

### 3.2 SYSTEM ACCEPTANCE

- A. Reference section 01770 for general requirements.

### 3.3 CLOSEOUT DOCUMENTATION

- A. Properly completed start-up forms, including equipment marks and serial numbers, documenting proper field quality control and proper system demonstration to the Owner prior to the testing and balancing prior to granting of substantial completion. Also, correction of deficiencies found by the Owner's testing and balancing agency shall be completed prior to the Owner's granting of substantial completion.

END OF SECTION 15950

## SECTION 15960 - PLUMBING SYSTEMS TESTING

### 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 video testing to confirm design objectives for the following:
  - 1. Sanitary Waste Piping Systems
  - 2. Kitchen Waste Piping System

### PART 2 - PRODUCTS AND PROCEDURES

#### 2.1 VIDEO INSPECTION OF UNDERGROUND SEWER MAINS

- A. The work specified in this section shall be performed by an independent contractor/consultant, who has had no involvement in the installation process. The contractor/consultant shall have had a minimum of three years experience in this type of work. The party performing the test shall indicate compliance in writing with these specifications and shall sign the report developed. To facilitate the work in this specification, the contractor will be provided with a drawing(s) showing the interior building layout with the layout of the underground piping system(s) with all floor cleanouts labeled with the same identifier as the as-built drawings. The contractor will use that same identifier throughout the documenting of the video inspection process and final report.
- B. The contractor will provide a video pipe inspection of all sanitary sewer mains four inch in diameter and larger, inside the building, and all mains outside the building to the point of connection to the existing system or manhole. Sewer mains shall be considered to be any sewer collecting effluent from more than one group of plumbing fixtures, or whose run from one group of plumbing fixtures is over fifty feet. Inspections will begin at accessible points to the system, such as cleanouts or manholes. For pipe sizes 4-inch, accessible openings shall be no more than 100 feet apart, and for larger diameter piping no more than 300 feet apart.
- C. For lines 4 inch – 6 inch in diameter, a color push camera system with a centering collar to raise the camera to the center of the pipe shall be used. The information on the screen will include displaying at the start of each segment the name of the contractor, date, time of day, and during the inspection the footage counter and most importantly the identification of from which point to which point (C.O. A-1 to B-1) the inspection is being done. The point references shall match the identifiers on the as-built drawings. The final video shall be delivered on DVD or CD in a common format that can be played on a PC computer. Some of the common formats include MPEG, AVI, or similar.
- D. For lines 8-inch and up, a main line camera system shall be used. This system shall have a pan and tilt camera and be equipped to provide the same display information as the push camera. The camera head shall be positioned as close to the centerline of the pipe as required to obtain a clear picture of the piping. The tractor moving the camera in the piping shall move at a speed no more than 0.5 feet per second.

- E. A transmitter will be attached to the camera head to provide above ground location of underground problems.
- F. The video pipe inspection shall observe and provide information on the condition of the pipe, joints, alignment, lateral locations, manholes, pipe size, pipe material and any pipe obstructions. The location of any underground problems shall be located above ground, and exact above ground location noted on the drawing and in the report.
- G. Submit a final inspection report comprised of a DVD or CD of the inspection, a written inspection report, and a marked-up drawing showing the above ground locations of any underground problems. The written report shall identify each pipe segment inspected, pipe size and material of that segment, footage, laterals, detailed description of damages or other problems, summary of pipe condition, and counter time. The responsible person in charge of the project shall sign this report.
- H. Notification of camera testing of underground lines shall be sent to Architects office 48 hours prior to actual test. The Owner's representative shall be present during the actual camera documentation of lines. A separate drawing shall be prepared showing all camera points of each area and submitted to the Owner. All retests of systems not properly cleaned and installed shall be at the expense of the Contractor.
- I. The underground video report shall be submitted within 60 days of the last building pad slab on grade pour.
- J. The final report shall be submitted 45 days prior to Substantial Completion.

### PART 3 - EXECUTION

#### 3.1 UNDER GROUND AND FINAL REPORT(S)

- A. General: Typewritten, or computer printout in letter-quality bond paper, in three-ring binder, tabulated and divided into sections by tested systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing Engineer.
- C. Report contents: In addition to certified field report data, include the following:
  - 1. DVD or CD(s).
  - 2. Drawings with corresponding data related to preparation of DVD or CD(s).
- D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
  - 1. Title page.
  - 2. Name and address of testing firm.
  - 3. Project name.
  - 4. Project location.
  - 5. Architect's name and address.
  - 6. Engineer's name and address.
  - 7. Contractor's name and address.
  - 8. Report date.
  - 9. Signature of testing firm representative who certifies.
  - 10. Table of Contents with the total number of pages defined for each section of the report.
- E. System Diagrams: Include schematic layouts of Sanitary piping systems. Present each system with single-line diagram and include the following:
  - 1. Start point of each segment.

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2. Stop point of each segment.
3. System tag related to tape footage.
4. Pipe sizes and locations.

### 3.2 SITE OBSERVATIONS

- A. The Contractor shall notify the Architect's office 48 hours in advance of a Video Inspection. The Owner's representative shall be present and witness the testing.

END OF SECTION 15960

## 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.
- E. Power Company Coordination - Coordinate the exact location of transformers with power company prior to bid. Include in the base bid any and all cost for installation, connection, concrete pad, meter, etc. Of the utility transformer. Run a 1" c with pull rope from the transformer meter to the HVAC EMS panel. Conduit shall not be run on transformer interior. Coordinate the exact location of the EMS panels with the HVAC contractor prior to rough-in. Contractor shall include in base bid all cost to fill out the Power Company's Load Information Sheets and submit them to the provider.

## 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
Telephone outlets	1'6"
Motor control equipment	5'0"
Fire alarm stations	4'0"
Knoxbox	6'5" to center
Fire alarm remote annunciator panel	4'0" to bottom
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
  - 0-10volt LED Diming Switches and lighting controls wiring drawings on the 1/8" scaled floor plans.
  - panelboards
  - switchboards
  - Fire alarm system with point to point wiring drawings on the 1/8" scaled floor plans.
  - Intercom system with point to point wiring drawings on the 1/8" scaled floor plans.
  - Security Cabling
  - other systems
  - dimensioned equipment room rough-in drawings
  - coordination drawings (if applicable)
  - Emergency Responder Radio Antenna Repeater System
  - Arc-Flash Hazard Analysis
  - Short-Circuit Studies
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.
- B. Mockups: Provide interior lighting fixtures, system devices, power, and all associated conduits 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. Label and color code all boxes and coverplates.
- C. The electrical contractor shall submit scaled floor plans indicating the proposed route of all feeders and circuit home runs. On separate drawings the contractor should submit the proposed route of all main systems (Fire Alarm, Intercom, and Security Conduits). Include on the systems drawings the proposed route of the building cable tray.

### 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 16057.13 - SHORT-CIRCUIT STUDIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Computer-based, fault-current study to determine minimum interrupting capacity of circuit protective devices.
- B. Related Requirements:
  - 1. Section 16057.19 "Arc-Flash Hazard Analysis" for arc-flash studies.

#### 1.2 DEFINITIONS

- A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled. Existing to remain items must remain functional throughout construction period.
- B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.
- D. SCCR: Short-circuit current rating.
- E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
- F. Single-Line Diagram: See "One-Line Diagram."

#### 1.3 ACTION SUBMITTALS

- A. Product Data:
  - 1. For power system analysis software to be used for studies.
- B. Short-Circuit Study Report:
  - 1. Submit the following after approval of system protective devices submittals. Submittals **must** be in digital form.
    - a. Short-circuit study input data, including completed computer program input data sheets.
    - b. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing,

- obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
- c. Revised one-line diagram, reflecting field investigation results and results of short-circuit study.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

#### 1.5 QUALITY ASSURANCE

- A. Study must be performed using commercially developed and distributed software designed specifically for power system analysis.
- B. Software algorithms must comply with requirements of standards and guides specified in this Section.
- C. Manual calculations are unacceptable.

### PART 2 - PRODUCTS

#### 2.1 POWER SYSTEM ANALYSIS SOFTWARE

- A. Comply with IEEE 399 and IEEE 551.
- B. Analytical features of power systems analysis software program must have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- C. Computer software program must be capable of plotting and diagramming time-current-characteristic curves as part of its output.
- D. Computer program must be designed to perform short-circuit studies or have function, component, or add-on module designed to perform short-circuit studies.
- E. Computer program must be developed under supervision of licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

#### 2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram of modeled power system, showing the following:
  - 1. Protective device designations and ampere ratings.
  - 2. Conductor types, sizes, and lengths.



3. Transformer kVA and voltage ratings.
  4. Motor and generator designations and kVA ratings.
  5. Elevator Motors.
  6. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
  7. Derating factors and environmental conditions.
  8. Any revisions to electrical equipment required by study.
- D. Comments and recommendations for system improvements or revisions in written document, separate from one-line diagram.
- E. Protective Device Evaluation:
1. Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment withstand ratings exceed available short-circuit current at equipment installation locations.
  2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
  3. For 600 V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
  4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in standards to 1/2-cycle symmetrical fault current.
  5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
- F. Short-Circuit Study Input Data:
1. One-line diagram of system being studied.
  2. Power sources available.
  3. Manufacturer, model, and interrupting rating of protective devices.
  4. Conductors.
  5. Transformer data.
- G. Short-Circuit Study Output Reports:
1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
    - a. Voltage.
    - b. Calculated fault-current magnitude and angle.
    - c. Fault-point X/R ratio.
    - d. Equivalent impedance.
  2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
    - a. Voltage.
    - b. Calculated symmetrical fault-current magnitude and angle.
    - c. Fault-point X/R ratio.
    - d. Calculated asymmetrical fault currents:

- 1) Based on fault-point X/R ratio.
  - 2) Based on calculated symmetrical value multiplied by 1.6.
  - 3) Based on calculated symmetrical value multiplied by 2.7.
3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
  - a. Voltage.
  - b. Calculated symmetrical fault-current magnitude and angle.
  - c. Fault-point X/R ratio.
  - d. No AC Decrement (NACD) ratio.
  - e. Equivalent impedance.
  - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on symmetrical basis.
  - g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on total basis.

### PART 3 - EXECUTION

#### 3.1 POWER SYSTEM DATA

- A. Obtain data necessary for conduct of study.
  1. Verify completeness of data supplied on one-line diagram. Call discrepancies to Architect's attention.
  2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
  3. For **equipment that** is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers in accordance with NFPA 70E.
- B. Gather and tabulate required input data to support short-circuit study. Comply with requirements in Section 017839 "Project Record Documents" for recording circuit protective device characteristics. Record data on Record Document copy of one-line diagram. Comply with recommendations in IEEE 551 as to amount of detail that is required to be acquired in field. Field data gathering must be by, or under supervision of, qualified electrical professional engineer. Data include, but are not limited to, the following:
  1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
  2. Obtain electrical power utility impedance at service.
  3. Power sources and ties.
  4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
  5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
  6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
  7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.

8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
9. Motor horsepower and NEMA MG 1 code letter designation.
10. Conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
11. Derating factors.

### 3.2 SHORT-CIRCUIT STUDY

- A. Perform study following general study procedures contained in IEEE 399.
- B. Calculate short-circuit currents according to IEEE 551.
- C. Base study on device characteristics supplied by device manufacturer.
- D. Extent of electrical power system to be studied is indicated on Drawings.
- E. Begin short-circuit current analysis at service, extending down to system overcurrent protective devices as follows:
  1. To normal system low-voltage load buses where fault current is 5 kA or less.
  2. Exclude equipment supplied by single transformer smaller than 30 kVA.
- F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study cases of system-switching configurations and alternate operations that could result in maximum fault conditions.
- G. Include ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for fault-current dc decrement to address asymmetrical requirements of interrupting equipment.
- H. Calculate short-circuit momentary and interrupting duties for three-phase bolted fault and single line-to-ground fault at each equipment indicated on one-line diagram.
  1. For grounded systems, provide bolted line-to-ground fault-current study for areas as defined for three-phase bolted fault short-circuit study.
- I. Include in report identification of protective device applied outside its capacity.

END OF SECTION 16057.13

## SECTION 16057.19 - ARC-FLASH HAZARD ANALYSIS

### PART 1 - GENERAL

#### A. Section Includes:

1. Computer-based, arc-flash study to determine arc-flash hazard distance and incident energy to which personnel could be exposed during work on or near electrical equipment.

#### B. Related Requirements:

1. Section 16057.13 "Short-Circuit Studies" for fault-current studies.

### 1.2 DEFINITIONS

- A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
- B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.
- D. p.u.: Per unit. The reference unit, established as a calculating convenience, for expressing all power system electrical parameters on a common reference base.
- E. SCCR: Short-circuit current rating.
- F. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
- G. Single-Line Diagram: See "One-Line Diagram."

### 1.3 ACTION SUBMITTALS

#### A. Product Data:

1. For power system analysis software to be used for studies.

#### B. Study Submittals:

1. Submit the following after approval of system protective devices submittals. Submittals **must** be in digital form:
  - a. Arc-flash study input data, including completed computer program input data sheets.
  - b. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

- c. Revised one-line diagram, reflecting field investigation results and results of arc-flash study.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

#### 1.5 QUALITY ASSURANCE

- A. Study must be performed using commercially developed and distributed software designed specifically for power system analysis.
- B. Software algorithms must comply with requirements of standards and guides specified in this Section.
- C. Manual calculations are unacceptable.

#### 1.6 REGULATORY AGENCY APPROVALS

- A. Submittals for arc-flash hazard analysis requiring approval by authorities having jurisdiction must be signed and sealed by qualified electrical professional engineer responsible for their preparation.

### PART 2 - PRODUCTS

#### 2.1 COMPUTER SOFTWARE

- A. Comply with IEEE 1584 and NFPA 70E.
- B. Analytical features of device coordination study computer software program must have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- C. Computer program must be designed to perform arc-flash analysis or have function, component, or add-on module designed to perform arc-flash analysis.
- D. Computer program must be developed under supervision of licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

#### 2.2 ARC-FLASH STUDY REPORT CONTENT

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
  2. Conductor types, sizes, and lengths.
  3. Transformer kVA and voltage ratings, including derating factors and environmental conditions.
  4. Motor, Elevator and generator designations and kVA ratings.
  5. Switchgear, switchboard, motor-control center, panelboard designations, and ratings.
- D. Study Input Data: As described in "Power System Data" Article.
- E. Short-Circuit Study Output Data: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
- F. Arc-Flash Study Output Reports:
1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in report:
    - a. Voltage.
    - b. Calculated symmetrical fault-current magnitude and angle.
    - c. Fault-point X/R ratio.
    - d. No AC Decrement (NACD) ratio.
    - e. Equivalent impedance.
    - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on symmetrical basis.
    - g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on total basis.
- G. Incident Energy and Flash Protection Boundary Calculations:
1. Arcing fault magnitude.
  2. Protective device clearing time.
  3. Duration of arc.
  4. Arc-flash boundary.
  5. Restricted approach boundary.
  6. Limited approach boundary.
  7. Working distance.
  8. Incident energy.
  9. Hazard risk category.
  10. Recommendations for arc-flash energy reduction.
- H. Fault study input data, case descriptions, and fault-current calculations including definition of terms and guide for interpretation of computer printout.
- 2.3 ARC-FLASH WARNING LABELS
- A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce 3.5 by 5 inch (76 by 127 mm) self-adhesive equipment label for each work location included in analysis.
- B. Label must have orange header with wording, "WARNING, ARC-FLASH HAZARD," and must include the following information taken directly from arc-flash hazard analysis:
1. Location designation.
  2. Nominal voltage.
  3. Protection boundaries.

- a. Arc-flash boundary.
  - b. Restricted approach boundary.
  - c. Limited approach boundary.
- 4. Arc flash PPE category.
  - 5. Required minimum arc rating of PPE in Cal/cm squared.
  - 6. Available incident energy.
  - 7. Working distance.
  - 8. Engineering report number, revision number, and issue date.
- C. Labels must be machine printed, with no field-applied markings.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

#### 3.2 ARC-FLASH HAZARD ANALYSIS

- A. Comply with NFPA 70E and its Annex D for hazard analysis study.
- B. Preparatory Studies: Perform **Short-Circuit study** prior to starting Arc-Flash Hazard Analysis.
- 1. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
- C. Calculate maximum and minimum contributions of fault-current size.
- 1. Maximum calculation must assume maximum contribution from utility and must assume motors to be operating under full-load conditions.
  - 2. Calculate arc-flash energy at 85 percent of maximum short-circuit current in accordance with IEEE 1584 recommendations.
  - 3. Calculate arc-flash energy at 38 percent of maximum short-circuit current in accordance with NFPA 70E recommendations.
  - 4. Calculate arc-flash energy with utility contribution at minimum and assume no motor contribution.
- D. Calculate arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.
- E. Include medium- and low-voltage equipment locations, except equipment fed from transformers smaller than 75 kVA.
- F. Calculate limited, restricted, and prohibited approach boundaries for each location.
- G. Incident energy calculations must consider accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations must take into account changing

current contributions, as sources are interrupted or decremented with time. Fault contribution from motors and generators must be decremented as follows:

1. Fault contribution from induction motors must not be considered beyond three to five cycles.
  2. Fault contribution from synchronous motors and generators must be decayed to match actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 p.u. to 3 p.u. after 10 cycles).
- H. Arc-flash energy must generally be reported for maximum of line or load side of circuit breaker. However, arc-flash computation must be performed and reported for both line and load side of circuit breaker as follows:
1. When circuit breaker is in separate enclosure.
  2. When line terminals of circuit breaker are separate from work location.
- I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

### 3.3 POWER SYSTEM DATA

- A. Obtain data necessary for conduct of arc-flash hazard analysis.
1. Verify completeness of data supplied on riser diagram and Panel Schedules on Drawings.
  2. For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.
  3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys conducted by qualified technicians and contractors.
- B. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to amount of detail that is required to be acquired in field. Field data gathering must be under direct supervision and control of engineer in charge of performing study, and must be by, or under supervision of, qualified electrical professional engineer. Data include, but are not limited to, the following:
1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
  2. Obtain electrical power utility impedance or available short circuit current at service.
  3. Power sources and ties.
  4. Short-circuit current at each system bus (three phase and line to ground).
  5. Full-load current of loads.
  6. Voltage level at each bus.
  7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
  8. For reactors, provide manufacturer and model designation, voltage rating and impedance.
  9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
  10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
  11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.



12. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
13. Motor horsepower and NEMA MG 1 code letter designation.
14. Low-voltage conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).

### 3.4 LABELING

- A. Apply arc-flash label on front cover **of each section of equipment and on side or rear covers with accessible live parts and hinged doors or removable plates** for each equipment included in study. Base arc-flash label data on highest values calculated at each location.
- B. Each piece of equipment listed below **not fed by single transformer smaller than 75 kVA** must have arc-flash label applied to it:
  1. Low-voltage switchgear.
  2. Switchboards.
  3. Panelboards.
  4. Motor-control centers.
  5. Low voltage transformers.
  6. Safety switches.
  7. Control panels.
  8. Elevator.
- C. Note on record Drawings location of equipment where personnel could be exposed to arc-flash hazard during their work.
  1. Indicate arc-flash energy.
  2. Indicate protection level required.

### 3.5 APPLICATION OF WARNING LABELS

- A. Install arc-flash warning labels under direct supervision and control of qualified electrical professional engineer.

END OF SECTION 16057.19

## 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.
- G. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
  1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
  2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

### 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.
- D. Grounding and Bonding for Piping:
  - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  - 2. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet of bare copper conductor not smaller than No. 3/0 AWG.
  - 1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
  - 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

### 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.

- B. Report measured ground resistances that exceed the following values:
  - 1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
  - 2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
  - 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
  - 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

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.
- B. Shop Drawings: Indicate materials and dimensions and identify hardware, including attachment and anchorage devices, signed and sealed by a qualified professional engineer. Professional engineer qualification requirements are specified in Division 1 Section "Quality Requirements." Include the following:
  - 1. Seismic Restraints: Detail anchorage and bracing not defined by details or charts on Drawings. Include the following:

- a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
  - b. Details: Detail fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events.
  - c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
- C. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.
  - D. Welding certificates.
  - E. Field quality-control test reports.

## 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. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands.
  1. Fire Alarm System: Red.
  2. Fire-Suppression Supervisory and Control System: Red and yellow.
  3. Combined Fire Alarm and Security System: Red and blue.
  4. Security System: Blue and yellow.
  5. Mechanical and Electrical Supervisory System: Green and blue.
  6. Telecommunication System: Green and yellow.
  7. Control Wiring: Green and red.
- B. 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.
- C. 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.
- D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
  1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
- E. 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.
- F. 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.
- G. 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.
- H. 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 "#"     |
| Emerg. Power | Paint YELLOW | mark "#"     |
| Fire Alarm   | Paint RED    | mark "FA-#"  |
| Intercom     | Paint Blue   | mark "I-#"   |
| Card Access  | Paint Orange | mark "CA-#"  |
| ALC Ctrls    | unpainted    | mark "ALC-#" |
| Security     | Paint Purple | mark "ADT-#" |

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. Electrical switchgear and switchboards.
  - d. Transformers.
  - e. Emergency system boxes and enclosures.
  - f. Disconnect switches.
  - g. Enclosed circuit breakers.
  - h. Motor starters.
  - i. Push-button stations.
  - j. Power transfer equipment.
  - k. Contactors.
  - l. Remote-controlled switches, dimmer modules, and control devices.
  - m. Voice and data cable terminal equipment.
  - n. Master clock and program equipment.
  - o. Intercommunication and call system master and staff stations.
  - p. Television/audio components, racks, and controls.
  - q. Fire-alarm control panel and annunciators.
  - r. Monitoring and control equipment.

### 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. Colors for 480/277-V Circuits:
  - a. Phase A: Brown.
  - b. Phase B: Orange.
  - c. Phase C: Yellow.
- 4. 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.

#### 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
  - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

- 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. 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.
- K. The transformer primary and secondary feeders shall be run in IMC or Rigid Steel Conduit with the last (3) three foot feeder connection to the transformer run in Liquid-Tight Flexible Metallic conduit.

### 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.

**All branch circuit and systems conduit shall be run in the walls and above the ceiling unless explicitly noted on the floor plans. (ONLY at the lab teachers demonstration tables and at low partition walls in the kitchen shall branch circuit wiring be allowed in the slab). All feeder conduits may be run below the slab.**

#### 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. LFMC: Liquidtight flexible metal conduit.
- F. LFNC: Liquidtight flexible nonmetallic conduit.
- G. NBR: Acrylonitrile-butadiene rubber.
- H. 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. Alfex 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. LFMC: Flexible steel conduit with PVC jacket.
- H. 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.

- I. 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. LFNC: UL 1660.
- D. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.
- E. Fittings for LFNC: UL 514B.

## 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 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Thomas & Betts Corporation.
    - b. Walker Systems, Inc.; Wiremold Company (The).
    - c. Wiremold Company (The); Electrical Sales Division.
- B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Butler Manufacturing Company; Walker Division.
    - b. Enduro Systems, Inc.; Composite Products Division.
    - c. Hubbell Incorporated; Wiring Device-Kellems Division.
    - d. Lamson & Sessions; Carlon Electrical Products.
    - e. Panduit Corp.
    - f. Walker Systems, Inc.; Wiremold Company (The).
    - g. Wiremold Company (The); Electrical Sales Division.

## 2.6 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.

## 2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. Description: Comply with SCTE 77.
  - 1. Color of Frame and Cover: Gray.
  - 2. Configuration: Units shall be designed for flush burial and have integral closed bottom, unless otherwise indicated.
  - 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
  - 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  - 5. Cover Legend: Molded lettering, "ELECTRIC" or "TELEPHONE" and as indicated for each service.
  - 6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
  - 7. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
- B. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product by one of the following:
    - a. Armorcast Products Company.
    - b. Carson Industries LLC.
    - c. Christy Concrete Products.
    - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.

- C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of cast iron.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product by one of the following:
    - a. Carson Industries LLC.
    - b. Christy Concrete Products.
    - c. Nordic Fiberglass, Inc.

## 2.8 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."

## 2.9 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.

## 2.10 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

## 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.
6. Application of Handholes and Boxes for Underground Wiring:
  - a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Fiberglass enclosures with polymer-concrete frame and cover SCTE 77, Tier 15 structural load rating.
  - b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Heavy-duty fiberglass units with polymer-concrete frame and cover, SCTE 77, Tier 8 structural load rating.
  - c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.

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. Raceways Embedded in Slabs:



1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  3. Change from Type EPC-40-PVC to rigid steel conduit, EMT or IMC before rising above the floor.
- I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:
1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
  2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
  3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  2. Where otherwise required by NFPA 70.
- N. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m).
1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
    - a. Outdoor Locations Not Exposed to Direct Sunlight: **125 deg F** temperature change.
    - b. Outdoor Locations Exposed to Direct Sunlight: **155 deg F** temperature change.
    - c. Indoor Spaces: Connected with the Outdoors without Physical Separation: **125 deg F** temperature change.
    - d. Platforms/Mezzanine: **115 deg F** temperature change.
  2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
  3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
- O. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semi recessed lighting fixtures. Use maximum of 36 inches of LFMC for noise transmission, or movement; and for transformers, HVAC Equipment, controls and motors. Use maximum of 36 inches of LFMC for CONNECTIONS TO ALL CEILING MOUNTED SYSTEM DEVICES (Fire Alarm, Intercom, etc.).

For all roof mounted equipment, devices and controls, IMC shall be run from below the ceiling through the roof. LFMC cable then shall be used to make the final connections.

P. Damp/Wet Locations:

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC in damp or wet locations not subject to severe physical damage.

Q. 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.

R. Set metal floor boxes level and flush with finished floor surface.

S. 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 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

- E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

### 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 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.

3.6 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.

3.7 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."

3.8 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. Snap switches and wall-box dimmers.
  - 5. Solid-state fan speed controls.
  - 6. Communications outlets.
  - 7. Pendant cord-connector devices.
  - 8. Cord and plug sets.
  - 9. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.
  - 10. ALL RECEPTACLES SHALL BE TAMPER RESISTANT/CHILD PROOF

#### 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).
- B. Isolated-Ground, Duplex 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. Hubbell; CR 5253IG.
    - b. Leviton; 5362-IG.
    - c. Pass & Seymour; IG6300.
  - 2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

- C. Tamper-Resistant 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; TR8300.
    - b. Hubbell; HBL8300SG.
    - c. Leviton; 8300-SGG.
    - d. Pass & Seymour; 63H.
  - 2. Description: Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

## 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
- C. Isolated-Ground, Duplex Convenience Receptacles:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; IG5362BLS.
    - b. Hubbell; IG5362SA.
    - c. Leviton; 5380-IG.
  - 2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

## 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 PENDANT CORD-CONNECTOR DEVICES



- A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.
  - 1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
  - 2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

## 2.6 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.

## 2.7 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
    - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
    - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
    - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).
- C. Key-Operated Switches, 120/277 V, 20 A:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 2221L.
    - b. Hubbell; HBL1221L.
    - c. Leviton; 1221-2L.
    - d. Pass & Seymour; PS20AC1-L.
  - 2. Description: Single pole, with factory-supplied key in lieu of switch handle.
- D. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 1995.
    - b. Hubbell; HBL1557.
    - c. Leviton; 1257.
    - d. Pass & Seymour; 1251.

## 2.8 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable **slider**; with single-pole or three-way switching. Comply with UL 1472.
- C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
  - 1. 1600 W; dimmers shall require no derating when ganged with other devices. Lutron Nova T series
- D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

## 2.9 COMMUNICATIONS OUTLETS

- 1. Refer to the Intercommunications/MATV specifications for additional information..

## 2.10 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.

## 2.11 FLOOR BOX SERVICE FITTINGS

- A. Type: Modular, flap-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Rectangular, die-cast aluminum with satin finish.
- D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Blank cover with bushed cable opening.
- F. Manufacturer shall be Wiremold Evolution EFB series floor box.

## 2.12 MULTIOUTLET ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hubbell Incorporated; Wiring Device-Kellems.

2. Wiremold Company (The).
  3. Panduit
- B. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- C. Raceway Material: Metal, with manufacturer's standard finish.
- D. Wire: No. 12 AWG.

## 2.13 SERVICE POLES

- A. Description: Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
1. Poles: Nominal ~~2.5-inch~~ square cross section, with height adequate to extend from floor to at least ~~6 inches~~ above ceiling, and with separate channels for power wiring and voice and data communication cabling.
  2. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
  3. Finishes: [Satin-anodized aluminum].
  4. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, 4-pair, Category 3 or 5 voice and data communication cables.
  5. Power Receptacles: Two duplex, 20-A, heavy-duty, NEMA WD 6 configuration 5-20R units.
  6. Voice and Data Communication Outlets: Blank insert with bushed cable opening

## 2.14 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. Wiring Devices Connected to Emergency Power System: [Red] .
  3. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

## PART 3 - EXECUTION

### 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. Pigtailling 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.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 16 Section "Electrical Identification."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with **black**-filled lettering on the back face of plate, and durable wire markers or tags inside outlet boxes.

### 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. Time switches.
  - 2. Outdoor photoelectric switches.
  - 3. Lighting contactors.
  - 4. Emergency shunt relays.
- 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 TIME SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Intermatic, Inc.
  - 2. Paragon Electric Co.; Invensys Climate Controls.
  - 3. Square D; Schneider Electric.
  - 4. TORK.
- B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.
  - 1. Contact Configuration: SPST, DPST, or DPDT.
  - 2. Contact Rating: 30-A inductive or resistive, 240-V ac, 20-A ballast load, 120/240-V ac.
  - 3. Program: 8 on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays].
  - 4. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
  - 5. Astronomic Time: All channels.
  - 6. Battery Backup: For schedules and time clock.

### 2.2 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Intermatic, Inc.
  - 2. Paragon Electric Co.; Invensys Climate Controls.
  - 3. Square D; Schneider Electric.
  - 4. TORK.
- B. Description: Solid state, with SPST or DPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
  - 1. Light-Level Monitoring Range: 1.5 to 10 fc , with an adjustment for turn-on and turn-off levels within that range and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
  - 2. Time Delay: 15-second minimum, to prevent false operation.
  - 3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
  - 4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

### 2.3 LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Allen-Bradley/Rockwell Automation.
  2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
  3. Eaton Electrical Inc.; Cutler-Hammer Products.
  4. GE Industrial Systems; Total Lighting Control.
  5. Square D; Schneider Electric.
  6. TORK.
- B. Description: Electrically operated and mechanically held, combination type with nonfused disconnect, complying with NEMA ICS 2 and UL 508.
1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
  2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
  3. Enclosure: Comply with NEMA 250.
  4. Provide with control and pilot devices as [indicated on Drawings matching the NEMA type specified for the enclosure. All lighting contactors shall have relays that would fail in the closed position so that the lights will remain "On".
  5. Furnish and install each lighting contactor with a integral H-O-A switch.

#### 2.4 EMERGENCY SHUNT RELAY

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Lighting Control and Design, Inc.
- B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual switching contacts; complying with UL 924.
1. Coil Rating: 120 V.

#### 2.5 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."

#### 2.6 MOTION DETECTORS:

Basis of Design Product - Watt Stopper wall mounted DT-200 Series and ceiling mounted DT-300 Series dual technology Occupancy Switches with BZ-50 universal voltage power pack/relay unit. Unit should be provided with auxiliary relay contacts for Owners future controls.

Subject to compliance with requirements, provide the product by one of the following:



Hubbell Lighting

Leviton Mfg. Company Inc.

Lithonia Lighting

Watt Stopper

The Dual Technology sensor shall be capable of detecting presence in the control area by detecting doppler shifts in transmitted ultrasound and passive infrared heat changes. Sensors shall use patent pending ultrasonic diffusion technology that spreads coverage to a wider area. Sensor shall utilize Dual Sensing Verification Principle for coordination between ultrasonic and PIR technologies. Detection verification of both technologies must occur in order to activate lighting systems. Upon verification, detection by either shall hold lighting on. Sensor shall have a retrigger feature in which detection by either technology shall retrigger the lighting system on within 5 seconds of being switched off. Sensors shall be ceiling mounted with a flat, unobtrusive appearance and provide 360° coverage.

Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall utilize Advanced Signal Processing that automatically adjusts the detection threshold dynamically to compensate for changing levels of activity and airflow throughout controlled space. To avoid false ON activations and to provide immunity to RFI and EMI, Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of a signal, to respond only to those signals caused by human motion. The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens. The lens shall be Poly IR4 material to offer superior performance in the infrared wavelengths and filter short wavelength IR, such as those emitted by the sun and other visible light sources. The lens shall have grooves facing in to avoid dust and residue build up which affects IR reception.

Sensors shall operate at 24 VDC/VAC and halfwave rectified and utilize a Watt Stopper power pack. Sensors shall utilize SmartSet™ technology to optimize time delay and sensitivity settings to fit occupant usage patterns. The use of SmartSet shall be selectable with a DIP switch. Sensors shall have a time delay that is adjusted automatically (with the SmartSet setting) or shall have a fixed time delay of 5 to 30 minutes, set by DIP switch. Sensors shall feature a walk-through mode, where lights turn off 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds.

Sensors shall have a built-in light level sensor that works from 10 to 300 footcandles. Sensors shall have a manual on function that is facilitated by installing a momentary switch. Sensors shall have eight occupancy logic options that give the ability to customize control to meet application needs. The sensors shall feature terminal style wiring, which makes installation easier.

Sensor shall have an additional single-pole, double throw isolated relay with normally open, normally closed and common outputs. The isolated relay is for use with HVAC control, data logging, and other control options.

Each sensing technology shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled. The LED can be disabled for applications that require less sensor visibility.

To ensure quality and reliability, sensor shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%. Sensors shall have standard 5 year warranty and shall be UL listed.

Submit wiring diagram for Occupancy Sensor, 0-10V diming switch and Daylight Harvesting Photocell. All three devices shall be by the same manufacturer.

2.6 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 Occupancy Sensor, 0-10V dimming switch. All devices shall be by the same manufacturer.

2.7 Daylight Harvesting Photocell:

1. Industry-exclusive fail-safe circuitry: in the event of product failure, return-to-closed feature causes the relay to default to ON which eliminates life safety concerns

2. Fade rate time setting 3-30 minutes

3. Controls 1-10V sinking ballast

4. Dim to OFF — over DDL for 30 seconds then lights OFF

5. Test Mode — 30 second fade rate for 15 minutes then auto exit

6. Measures light from any source in the visible spectrum within a 60° cone at 8-12' mounting height

7. Provides continual measurements to control the lighting

8. Mounts on ceiling — surface mount or low-profile flush mount

9. LED status indicators for ease of installation.

Contractor to furnish and install all power packs, control wiring, etc. Control wiring shall be the same insulation rating as the power conductors and run in the same conduit. Contractor may upsize conduit to allow for control cables.

Manufacturer – Leviton ODCOP-DOW series. Submit wiring diagram for Occupancy Sensor, 0-10V dimming switch and Daylight Harvesting Photocell. All three devices shall be by the same manufacturer.

Field Quality Control:

Functional testing for automatic lighting controls is required and covered specifically in the IECC C408.3. This contractor shall hire a third-party commissioning agent from those listed below to perform this service. All associated cost for the commissioning shall be included in the base bid.

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## 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. Fusible switches.
  - 2. Nonfusible switches.
  - 3. Bolted-pressure contact switches.
  - 4. High-pressure, butt-type contact switches.
  - 5. Molded-case circuit breakers.
  - 6. Molded-case switches.
  - 7. 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 FUSIBLE AND NONFUSIBLE 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. Fusible Switch, **600A** and Smaller: NEMA KS 1, Type **HD**, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Nonfusible Switch, **600A** and Smaller: NEMA KS 1, Type **HD**, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- D. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
  - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper neutral conductors.

### 2.3 FUSED POWER CIRCUIT DEVICES

- A. High-Pressure, Butt-Type Contact Switch: UL 977; operating mechanism shall use butt-type contacts and a spring-charged mechanism to produce and maintain high-contact pressure when switch is closed.
  - 1. Manufacturers:
    - a. General Electric Co.; Electrical Distribution & Control Division.
  - 2. Main Contact Interrupting Capability: Twelve times the switch current rating, minimum.
  - 3. Operating Mechanism: Manual handle operation to close switch stores energy in mechanism for closing and opening.

- a. Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
4. Service-Rated Switches: Labeled for use as service equipment.
5. Ground-Fault Relay: Comply with UL 1053. Self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.
  - a. Configuration: **Integrally mounted** relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground fault indicator.
  - b. Test Control: Simulates ground fault to test relay and switch (or relay only if "no-trip" mode is selected).
6. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.

## 2.4 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.



## 2.5 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.
- E. Transient Voltage Suppression Device: IEEE C62.41, integrally mounted, plug-in-style, solid-state, parallel-connected, sine-wave tracking suppression and filtering modules.
  - 1. Minimum Single-Impulse Current Ratings:
    - a. Line to Neutral: 100,000 A.
    - b. Line to Ground: 100,000 A.
    - c. Neutral to Ground: 50,000 A.
  - 2. Protection modes shall be as follows:
    - a. Line to neutral.
    - b. Line to ground.
    - c. Neutral to ground.
  - 3. EMI/RFI Noise Attenuation Using 50-ohm Insertion Loss Test: 55 dB at 100 kHz.
  - 4. Maximum UL 1449 Clamping Levels: 400 V, line to neutral and line to ground on 120/208 V, 800 V, line to neutral and line to ground on 277/480 V systems.
  - 5. Withstand Capabilities: 3000 Category C surges with less than 5 percent change in clamping voltage.
  - 6. Accessories:
    - a. Audible alarm activated on failure of any surge diversion module.
    - b. Six-digit transient-counter set to total transient surges that deviate from the sine-wave envelope by more than 125 V.

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.
- C. Fuses are specified in Division 16 Section "Fuses."

## 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 16491 - FUSES

### 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. Cartridge fuses rated 600 V and less for use in **switches**
  - 2. Spare-fuse cabinets.

#### 1.3 SUBMITTALS

- A. Product Data: Include the following for each fuse type indicated:
  - 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
  - 2. Let-through current curves for fuses with current-limiting characteristics.
  - 3. Time-current curves, coordination charts and tables, and related data.
  - 4. Fuse size for elevator feeders and elevator disconnect switches.
- B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Division 1 Section "**Closeout Procedures**" include the following:
    - a. Let-through current curves for fuses with current-limiting characteristics.
    - b. Time-current curves, coordination charts and tables, and related data.
    - c. Ambient temperature adjustment information.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses from a single manufacturer.
- 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 NEMA FU 1.
- D. Comply with NFPA 70.

#### 1.5 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

#### 1.6 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

#### 1.7 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. Fuses: Quantity no fewer than seven of each type and size.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Bussman, Inc.
  - 2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.
  - 3. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

#### 2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

#### 2.3 SPARE-FUSE CABINET

- A. Cabinet: Wall-mounted, 0.05-inch- thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull. Locate this cabinet in the main electrical room.
  - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
  - 2. Finish: Gray, baked enamel.
  - 3. Identification: "SPARE FUSES" in 1-1/2-inch- high letters on exterior of door.
  - 4. Fuse Pullers: For each size of fuse.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

- B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 FUSE APPLICATIONS

- A. Service Entrance: Class **L, dual element time delay, current limiting.**
- B. Motor Branch Circuits: Class **RK1 dual element time delay, current limiting.**
- C. Other Branch Circuits: Class **RK1 dual element time delay, current limiting .**
- D. Fuse all HVAC and plumbing equipment according to the manufacturer's specifications. Include all fuse adaptors to install smaller size fuses in larger disconnect switches as required by the manufacturer (IE 25A Fuse in a 60A/3P disconnect switch).

### 3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s).

### 3.4 IDENTIFICATION

- A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 16491

## 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 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. Electronic Ballasts: Comply with ANSI C82.11; instant start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.

1. Sound Rating: A.
2. Total Harmonic Distortion Rating: Less than 10 percent.
3. Transient Voltage Protection: IEEE C62.41, Category A or better.
4. Operating Frequency: 20 kHz or higher.
5. Lamp Current Crest Factor: 1.7 or less.
6. BF: 0.85 or higher.
7. Power Factor: 0.95 or higher.

B. Electronic Programmed-Start Ballasts for T5 Lamps: Comply with ANSI C82.11 and the following:

1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher, unless otherwise indicated.
9. Power Factor: 0.95 or higher.

C. Single Ballasts for Multiple Lighting Fixtures shall not be allowed. :

D. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

1. Dimming Range: 100 to 5 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 20 percent of normal.



3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
- E. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.
1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
    - a. High-Level Operation: 100 percent of rated lamp lumens.
    - b. Low-Level Operation: 50 percent of rated lamp lumens.
  2. Ballast shall provide equal current to each lamp in each operating mode.
  3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

## 2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

- A. Description: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
1. Lamp end-of-life detection and shutdown circuit.
  2. Automatic lamp starting after lamp replacement.
  3. Sound Rating: A.
  4. Total Harmonic Distortion Rating: Less than 20 percent.
  5. Transient Voltage Protection: IEEE C62.41, Category A or better.
  6. Operating Frequency: 20 kHz or higher.
  7. Lamp Current Crest Factor: 1.7 or less.
  8. BF: 0.95 or higher, unless otherwise indicated.
  9. Power Factor: 0.95 or higher.
  10. Ballast Case Temperature: 75 deg C, maximum.

## 2.5 BALLASTS FOR HID LAMPS

- A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features, unless otherwise indicated:
1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
  2. Minimum Starting Temperature: Minus 22 deg F for single-lamp ballasts.
  3. Normal Ambient Operating Temperature: 104 deg F .
  4. Open-circuit operation that will not reduce average life.
  5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.
- B. Auxiliary Instant-On Quartz System: Factory-installed feature automatically switches quartz lamp on when fixture is initially energized and when power outages occur. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent light output.
- C. High-Pressure Sodium Ballasts: Electromagnetic type, with solid-state igniter/starter. Igniter-starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.

1. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.
  - a. Restrike Range: 105- to 130-V ac.
  - b. Maximum Voltage: 250-V peak or 150-V ac RMS.
2. Minimum Starting Temperature: Minus 40 deg F (Minus 40 deg C).
3. Open-circuit operation shall not reduce average lamp life.

## 2.6 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.

## 2.7 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).

## 2.8 HID LAMPS

- A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature [1900] <Insert value> K, and average rated life of 24,000 hours, minimum.
- B. Metal-Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature 4000 K.

## 2.9 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

SECTION 16539 - EMERGENCY RESPONDER RADIO ANTENNA REPEATER SYSTEM

PART 1 - GENERAL

1.1 APPROVED VENDORS

- A. Dade County School District (DCSD) restricts the work performed in this specification section to one of the following approved vendors:
  - 1. Mobile Communications America
  - 2. Diversified Electronics, Inc

1.2 DESCRIPTIVE NARRATIVE

- A. 700/800 MHZ Communication Enhancement System shall support Public Safety & Emergency Responders Radio Communications. System shall provide capabilities for existing emergency responder's radio/ communication equipment to function at a transmission success rate per current adopted NFPA 1 to include Annex "O".

1.3 SUMMARY

Furnish, install, and test a complete and operating 700/800 MHZ Communication Enhancement System that only amplifies Dade County's public safety radio system.

This Section includes the requirements for an 800 MHZ Communication Enhancement System for the purposes of amplifying Emergency Responder radio signals to achieve minimum signal strengths.

- 1. Critical areas, such as the emergency command center(s), the fire pump room(s), exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas deemed critical by the AHJ, shall be provided with 99 percent floor area radio coverage.
- 2. General Building Areas. General building areas shall be provided with 95 percent floor area radio coverage.

Coordination shall be performed with local AHJ's.

The Owners ' private security and/or maintenance personnel radio systems, etc. shall not transmit **over** Public Safety & Emergency Responders Radio Communications without approval of AHJ's.

Final acceptance and approval is required from the AHJ(s) in writing prior to contract closeout.

Section Includes

1. Bi-directional amplifiers (BDA's)
2. Distributed Antenna System
3. Coaxial cables
4. Splitters and direction couplers
5. UPS - Customer provided
6. All other equipment and components necessary for a complete and functioning Emergency Responder Radio Antenna/Repeater System.

1.4 REGULATIONS

A. Comply with most recent adopted codes, regulations and standards referenced herein:

1. NFPA 1 - The National Fire Code (including Annex O)
2. NFPA 70 - The National Electrical Code
3. Georgia Life Safety Code
4. NFPA 101, Life Safety Code
5. NFPA 72-10 National Fire Alarm Code
6. FCC 47 CFR Private Land Mobile Radio
7. 90.219-2007 Services-Use of Signal Boosters
8. ICC 2009 International Fire Code, Code and Commentary
9. S ADA "Americans with Disabilities Act"
10. FCC's OET 65 Standards "Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields".
11. FCC Rules Part 22, Part 90 and Part 101

1.5 DEFINITIONS

A. Definitions:

1. Bi-Directional Amplifier BOA: Device used to amplify band-selective or multi-band RF signals in the uplink, to the base station for enhanced signals and improved coverage.
2. 800 MHZ Communication Enhancement System: A two-way radio communication system installed to assure the effective operation of radio communications systems for fire, emergency medical services or law enforcement agencies within a building or structure. A system used by firefighters, police, and other emergency services personnel.
3. Delivered Audio Quality Definitions (DAQ): This is a universal standard often cited in system designs and specifications.
  - a. DAQ 1: Unusable, speech present but unreadable.
  - b. DAQ 2: Understandable with considerable effort. Frequent repetition due to

noise/distortion.

- c. DAQ 3: Speech understandable with slight effort. Occasional repetition required due to noise/distortion.
- d. DAQ 3.5: Speech understandable with repetition only rarely required. Some noise/distortion
- e. DAQ 4: Speech easily understood. Occasional noise/distortion.
- f. DAQ 4.5: Speech easily understood. Infrequent noise/distortion.
- g. DAQ 5: Speech easily understood. Coupled Bonding Conductor (CBC) - The term "Coupled Bonding Conductor" shall mean a bonding conductor placed, e.g. strapped, on the outside of any technology cable, used to suppress transient noise.
- h. FCC: Federal Communications Commission
- i. OET 65 Standards: FCC's Bulletin 65 provides Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.
- j. Public Safety/First Responder: Public Safety or First Responder agencies which are charged with the responsibility of responding to emergency situations. These include, but are not limited to: law enforcement departments, fire departments, and emergency medical companies.

#### 1.6 SUBMITTALS

- A. Submit product data for each type of proposed system component specified, including dimensioned drawings showing minimum clearances and installed features. All shop drawing shall be digitally transmitted to the Architect in "PDF" format.
- B. Layout Drawings
  - 1. Component specification sheets shall be 8 inch x 11 inch or greater, scaled or dimensioned, with dimensions or scale clearly noted.
  - 2. Floor plan drawings shall be 30 inch x 42 inch minimum with drawings scaled to legible size.
  - 3. Floor plan drawings shall include elevation detail names for each elevation view. Sheet title shall include site name, address, sheet number, floor plan number and north arrow. Include site plan view of the subject buildings and surrounding property to clearly indicate the location and orientation of roof mounted outdoor antennas associated with the proposed system.
  - 4. Include a minimum of (1) building elevation depicting the location of any outdoor antennas associated with the proposed system. Include height of antenna centerline above building, orientation, and location of all external grounding connections.
  - 5. Include a detail plan view of all Telecommunications Spaces housing head-end and/or other consolidated equipment, showing the location of the rack(s) and/or enclosure(s) of the Emergency Responder Radio Antenna/Repeater System equipment.
- 6. Include a separate plan view of each interior floor where indoor antenna systems are proposed. Include antenna numbers, coaxial cable routes, and the locations of any other system components including splitters, couplers, filters, amplifiers, etc. All components shall be named or labeled for reference in power budget calculations

tables. Overlay approximated coverage radii indicating -95 dBm downlink (base to mobile) signal strength around each proposed indoor coverage antenna. Include results of any previous coverage testing per grid, if available.

7. Include a minimum of one (1) detail elevation view(s) of all rack(s) and/or enclosure(s) housing the Emergency Responder Radio Amplifier System (Signal Booster) equipment. Identify each piece of equipment by brand, model number and equipment type (e.g. Acme BA123 RF amplifier).
8. Specify antenna grounding and surge protection in accordance with NEC Article 810.
9. Specify the backup power source (Life Safety) and include calculations to ensure the backup power requirements as specified in this standard are met.

C. Equipment Specification Sheets

1. Provide copies of manufacturer specification sheets of all system components, including:
  - a. Amplifiers - Signal Boosters
  - b. Antennas
  - c. Coaxial cable, couplers, splitters, combiners, or other passive components
2. Operation and maintenance data
3. Pass band curves in for the uplink and downlink portions of the NPSPAC band for any amplifiers, if not included in #1. Amplifiers may NOT amplify portions of other licensed services, including Nextel and Specialized Mobile Radio Licensee band, or Cellular A or B bands.
4. Backup battery and charging system.

- D. Submit wiring diagrams from manufacturer differentiating clearly between factory and field-installed wiring. Include diagrams for each component of the system with all terminals and interconnections identified. Make all diagrams specific to this Project.
- E. Submit product certificates signed by the manufacturer of radio system components certifying that their products comply with specified requirements.
- F. Submit agenda for training class and copies of all handouts for the class.
- G. Maintenance data for radio system shall be included in the operation and maintenance manual. Include data for each type of product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations that carry stock of repair parts for the system to be furnished.
- H. Record of field tests of the radio system shall be included in the operation and maintenance manuals.
- I. Design Approval: Plans shall be submitted and approved prior to installation. The following information shall be provided to the local AHJ(s) representative by the system designer/Contractor:



1. A minimum of Two (2) copies of detailed drawings showing the location of the amplification equipment and associated antenna systems which includes a view showing building access to the equipment; and
2. A minimum of two (2) copies of schematic drawings of the electrical system, backup power, antenna system and any other associated equipment relative to the amplification equipment including panel locations and labeling.
3. A minimum of (1) copy of the Manufacturer's data sheets on all equipment to be installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Submit applicable licenses and certification.
2. Engage an experienced factory - authorized installer to perform work of this Section.
3. System design and lead installer shall have a valid FCC General Radio Operators License.

B. Single-Source Responsibility: Obtain radio system components from a single source who assumes responsibility for compatibility of system components.

C. All equipment shall be UL listed and labeled, and in accordance with applicable NEMA and ANSI Standards. Where copper cabling is routed to an area, either in another building, or with a separate electrical service, the Technology Contractor shall provide primary protective equipment.

D. MANUFACTURERS

E. Subject to compliance with requirements, available Integrators offering products that may be incorporated into the Work include, but are not limited to, the following:

1. CommScope/Andrew
2. Corning
3. Times Microwave
4. Tessco
5. CCI (Communication Components Inc.)
6. Solid Technologies
7. Bird Technologies

PART 2 - PRODUCTS

2.1 GENERAL PERFORMANCE REQUIREMENTS

- A. Compatibility: The equipment, including but not limited to repeaters, transmitters, receivers, signal boosters, cabling, fiber distributed antenna system, etc., shall not interfere with the existing communication systems utilized by the Public Safety and First Responder agencies.
- B. Power Supplies: At least two (2) independent and reliable power supplies shall be

provided, one primary and one secondary. The primary power source shall be supplied from a dedicated 20 ampere branch circuit and comply with 4.4.1.4 of NFPA 72. The secondary power source shall be a dedicated battery, capable of operating the in-building radio system for at least 12 hours of 100% system operation. The battery system shall automatically charge in the presence of external power input. The battery system shall be contained in one NEMA 1. Monitoring the integrity of power supplies shall be in accordance with 10.17.2 and 10.17.3 of NFPA 72. Where the contractor requires power to the system components, he shall run ½" C & #10 conductors and ground to the nearest 120-volt emergency panel and connect to a spare 20a/1p breaker.

C. Survivability

1. Physical Protection: All wiring and fiber optics shall be installed in conduit. Refer to Section 26 05 33, "Raceways and Boxes for Electrical Systems" for type, sizing and install at ion standards. Cabling shall be run in conduit where installed in exposed ceilings. All cabling shall be plenum rated.
2. Fire Performance: **All** main risers or trunks of the antenna system shall be installed with resistance to attack from a fire using one of the following methods:
  - a. A 2-hour fire rated cable or cable system.
  - b. Routing the cable through a 2-hour fire rated enclosure(s) or shaft(s).
  - c. A system configured in a looped design, routed through 1-hour fire rated enclosure(s) or shaft(s). The circuit shall be capable of transmitting and receiving a signal during a single open or non- simultaneous single ground fault on a circuit conductor.
  - d. Performance alternative approved by the authority having jurisdiction.
3. Cabinet: The signal booster and all associated RF filters shall be housed in a single NEMA 4 cabinet. Exterior locations require NEMA 4 certified, painted steel weather tight box. The cabinet shall be large enough to dissipate internal heat without venting the inside of the cabinet to the outside atmosphere. Operating temperatures: -22 degrees F to +120 degrees F (-30 degrees C to +50 degrees C) minimum temperature range, including microprocessors. Equipment installed on the roof of structures shall be rated for the expected extreme temperatures associated with rooftop installations.
4. Passive Equipment: Passband shall be 700/800 MHz, IP rating of 2 GHz.
5. Cable: Passband shall be 700-900 MHz Cable shall be rated for fire plenum and riser rating.

2.2 SYSTEM COMPONENTS

A. Signal Strength

1. Downlink: A minimum signal strength of -95 dBm shall be provided throughout the coverage area.
2. Uplink: Minimum signal strength of -95 dBm received at the local Fire Department Radio System from the coverage area.
3. A donor antenna must maintain isolation from the distributed antenna system. The donor antenna signal level shall be a minimum of 15 dB above the distributed antenna system under all operating conditions.

B. Permissible Systems

1. Buildings and structures shall be equipped with an FCC Certificated Class A (Channelized) Bi- Directional **UHF** Amplifier(s) as needed.
2. The distributed antenna system may utilize a radiating cable, fixed antennas or a combination *of* both.

C. Supported Frequencies: The radio system shall support frequencies in the 700 and 800 MHz public safety bands as utilized by the local AHJ(s).

D. Reject Filters: Notch filter sections shall be incorporated to minimize adjacent channel cellular and Specialized Mobil Radio (SMR) degradation of the signal booster performance. The minimum downlink band adjacent band rejection shall be 35 dB or greater at 865 MHz and 870 MHz.

E. Band Migration Capability: The signal booster shall include re-tunable or replaceable filters to accommodate rapid and economic passband changes in the event of mandatory FCC changes within the NPSPEC band. The use of non-adjustable and non-replaceable RF input and output filters is prohibited.

F. Output Level Control: An automatic output leveling circuit shall be included for both passbands with a minimum dynamic range of 60 dB, less any gain reduction setting, to maintain FCC out of band and spurious emission compliance.

G. Degraded Performance in Emergencies; The system shall be designed to allow degraded performance in adverse conditions, such as abnormally high temperatures resulting from nearby fires, extreme voltage fluctuations or other abnormal conditions that may occur during an emergency. Circuits that intentionally disable the signal booster in such situations (i.e. under/over voltage, over/under current, over/under temperature, etc.) will not be implemented as the standard mode for public safety applications.

H. Mode of Operation: The system shall be normally powered on. Unless design criteria prohibits continuous passing of frequencies, passing of frequencies shall be continuous during normally powered conditions within the Public Safety and First Responder bands.

I. All in-building radio systems shall be compatible with both analog and digital communications simultaneously at the time of installation.

2.3 SYSTEM MONITORING

A. The distributed antenna system shall include a connection to the fire alarm system to monitor the integrity of the circuit of the signal booster(s) and power supplies and annunciate this malfunction on the fire alarm system shall comply with 10.17.2 & 3 of NFPA 72.

B. A sign shall be located at the fire alarm panel with the name and telephone number of the local Fire Department indicating that they shall be notified of any failures that extend past the 2 hour time limit.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

#### A. Distribution System Signal Wires and Cables

1. Wires and cables shall enter each equipment enclosure, console, cabinet in such a manner that all doors or access panels can be opened and closed without removal or disruption of the cables.
2. Routing and Interconnection
  - a. Wires or cables routed between consoles, cabinets, and other equipment shall be installed in an approved conduit or cable tray that is secured to building structure.
  - b. Completely test all of the cables after installation and replace any that are found to be defective.
3. Install cables without damaging conductors, shield, or jacket.
4. Do not bend cables, while handling or installing, to radii smaller than as recommended by manufacturer.
5. Pull cables without exceeding cable manufacturer's recommended pulling tensions.

#### B. Product Delivery, Storage, and Handling

1. Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name and equipment model and serial identification numbers.
2. Store and protect equipment in a conditioned space until installation.

#### C. System Installation

1. Coaxial antenna cabling shall not be installed in the same conduit, raceway, or cable trays used for other systems.
2. All equipment shall be connected according to the OEM's specifications to insure correct installation and system performance.
3. Coordinate all roof penetrations with Owner and/or roofing contractor.

### 3.2 LICENSING

- A. All fees associated with the licensing shall be paid by the Owner.
- B. All testing must be done on frequencies authorized by the FCC.

### 3.3 GROUNDING

- A. Ground cable shields and equipment per Manufacturer's requirements.
- B. Antenna mast shall be grounded per NFPA 70 NEC requirements and antenna manufacturer's requirements. Provide grounding blocks and surge protection for outside coaxial cabling.

#### 3.4 APPROVAL TESTING

- A. The local AHJ's will review plans and specifications. Upon acceptance, plans will be stamped to indicate approval. Stamped plans are required to be present at the acceptance test. Any field changes that occur during construction shall be incorporated into new Record Drawings, including any manufacturer's data sheets for any equipment changes not submitted in the original submittal. Record Drawings, if required due to system changes, shall be submitted to the local AHJ for record and approval.
- B. Tests shall be made using frequencies close to the frequencies used by Public Safety/Emergency Responders. If testing is done on the actual frequencies, then this testing must be coordinated with the local AHJ and Public Safety Offices. All testing must be done on frequencies authorized by the FCC. A valid FCC license will be required if testing is done on frequencies different from the police, fire or emergency medical frequencies.
- C. Testing Procedures
  - 1. Minimum Signal Strength: For testing system signal strength and quality, the testing shall be based on the delivered audio quality (DAQ) system. A DAQ level below 3.0 shall be considered a failed test for a given grid cell.
  - 2. Measurements shall be made with the antenna held in a vertical position at 3 to 4 feet above the floor to simulate a typical portable radio worn on the belt or turnout coat pocket.
- D. Final Acceptance Testing
  - 1. All acceptance testing shall be done in the presence of a local AHJ representative or Public Safety Official at no expense to the City.
  - 2. Small scale drawings (11-inch x 17 inch maximum) of the structure shall be provided by the Contractor to the Owner. The plans shall show each floor divided into the grids as described above, and the results of the pre-testing. Each grid shall be labeled to indicate the DAQ result from the final acceptance testing.
  - 3. The Contractor shall provide the latest approved plans for the system, including any manufacture's data sheets for any equipment changes not submitted in the original submittal to the Owner. Include testing results of the repeater (output wattage, gain level, etc.) and connection to the fire alarm.
  - 4. AHJ is requesting the following testing procedure: A grid is overlaid onto a floor area to provide 20 grid cells. Grid cells are provided with definite minimum and maximum dimensions. For most buildings, using a minimum grid dimension of 20 ft (6.1 m) and a maximum grid dimension of 80 ft (24.4

m) will suffice to encompass the entire floor area. Where a floor exceeds 128,000 ft<sup>2</sup> (11,900 m<sup>2</sup>), which is the floor area that can be covered by the maximum grid dimension of 80 ft (24.4 m), it is recommended that the floor be subdivided into sectors each having an area of less than or equal to 128,000 ft<sup>2</sup> (11,900 m<sup>2</sup>), and each sector be tested individually with 20 grid cells in each sector. Signal strength measurements shall be taken at the center of each grid and shall be performed using standardized parameters as specified in CO6930 .001. 00 Part 1.4. A.3 Signal strength typically is recorded on the Delivered Audio Quality (DAQ) scale.

### 3.5 MAINTENANCE AND ANNUAL TESTING

#### A. Annual tests will be conducted by the local AHJ or authorized representative,

1. The re-testing will be done at no expense to the City or the appropriate emergency services departments as required in the original testing procedures.

#### B. Maintenance Contract

1. Maintenance contract with a Radio Service Provider in place with name of authorized company, who will provide a 24 hour by 7-day emergency response within two (2) hours after notification. The system shall be maintained in accordance with FCC requirements. The contract shall be for 5 years.
2. All tests shall be conducted, documented, and signed by a person in possession of a current FCC General Radio telephone Operator License, or a technician certification issued by the Association of Public-Safety Communications Officials International (APCO) or equivalent as determined by the local Fire Department.
3. Maintain a list of contact personnel with phone numbers at the radio repeater system cabinet. The contact personnel shall have knowledge of the building and the repeater system and be available to respond to the building in the case of an emergency.
4. Radio Service Provider maintenance contract shall include but not limited to:
  - a. Annual Test
    - 1) All active components of the distributed antenna system, including but not limited to amplifier, power supplies, and back-up batteries, shall be tested a minimum of once every 12 months.
    - 2) Amplifiers shall be tested to ensure that the gain is the same as it was upon initial installation and acceptance. The original gain shall be noted and any change in gain shall be documented.
    - 3) Back-up batteries and power supplies shall be tested under load for a period of 1 hour to verify that they will operate during an actual power outage.
    - 4) Active components shall be checked to determine that they are operating within the manufacturer's specifications for their intended purpose.
    - 5) Documentation of the test shall be maintained on site and copies

A New Classroom Addition for:  
Davis Elementary School

SECTION 16539  
Emergency Responder Radio Antenna Repeater Systems

delivered to the Dade County Fire Marshal's Office.

5. Fire Department Radio personnel, after providing reasonable notice to the Owner or their representative, shall have the right to enter onto the property to conduct field testing to be certain that the required level of radio coverage is present.

END OF SECTION 16539

## SECTION 16655 - STRUCTURED CABLING SYSTEM

### PART 1 - GENERAL

#### 1 PART 1 - GENERAL

##### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

##### 1.02 DESCRIPTION OF WORK

- A. Furnish all labor, materials, tools and equipment necessary for complete installation and checkout of the system as outlined in these specifications.

##### 1.04 SHOP DRAWINGS

- A. Submit drawings on the system and all its components including cut sheets, wiring diagrams, schematics and interconnections. All shop drawing data including wiring diagrams shall be turned over to the architect and owner at the end of the project as part of the contract close out documents.
- B. Literature for each separate type of equipment being provided shall indicate model number on the cut-sheet.
- C. The one line schematic of the complete system shall be on a floor plan to scale. Show locations and the type of outlets, as well as all equipment cabinets, rack locations, and structured cabling type.

##### 1.05 MANUALS

- A. The manufacturer shall furnish a minimum of three (3) complete sets of operating instructions and a service maintenance manual. This shall include internal schematics and wiring diagrams, detailed to allow a technician to install, operate, maintain, calibrate and repair the equipment.
- B. Documentation of testing on all wiring and terminations as per TIA/EIA standards shall be included in the project close-out documents.

##### 1.06 WORK INCLUDED

- A. Provisions for a complete structured cabling system including:
  - 1. Communication outlets as detailed on drawings
  - 2. Cabling (Category 6e and fiber)
  - 3. Conduit and boxes
  - 4. Data patch panels, termination hardware, equipment cabinets, relay racks and overhead cable tray, Plywood backboards  
Inter-building connectivity  
Grounding

##### 1.07 SCOPE OF PROJECT STANDARDS AND DESCRIPTION

- A. The structured cabling placed on this undertaking shall be Category 6e, 350MHz, Plenum-rated, "Unshielded Twisted Pair" type and conform to the requirements contained in the latest editions of the Na-



tional Electric Code (NEC) and the latest editions of the following American National Standards Institute (ANSI) specifications:

TIA/EIA-568 Commercial Building Telecommunications Wiring Standard

TIA/EIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces

TIA/EIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications

Supplements to EIA/TIA-568 Technical Systems Bulletins

TSB-36 Additional Transmission Specifications for Unshielded Twisted Pair Cables

TSB-40 Additional Transmission Specifications for Unshielded Twisted Pair Hardware

#### 1.08 WORKMANSHIP

- A. All work shall be performed in a workmanlike manner. Architect, Engineer, and/or Owner may observe the work procedures and workmanship of the Contractor but such observation will not relieve the contractor from responsibility for performance.

#### 1.09 WARRANTY

- A. The Contractor shall furnish a written warranty from the manufacturer that describes the network cabling and associated equipment supplied under these specifications will be free from defects of materials and workmanship for a period of fifteen years and the cable plant/labor will be free from defects of materials and workmanship for a period of fifteen years from the date of final acceptance unless otherwise specified and that all defects occurring within that period shall be corrected in a timely manner at no cost to the Owner.

#### 1.10 CONTRACTOR'S QUALIFICATIONS

- A. Contractor shall be required, before awarding of contract, to demonstrate to the complete satisfaction of the Architect that they have the necessary facilities, ability and financial resources to execute the work in a satisfactory manner and within the time specified; that they that they have been in the structured cabling business for 3 years and references which will assure the Owner of his qualifications for executing the work.
- B. Contractor shall submit a copy of a valid low-voltage license in the State of Georgia (Low-Voltage Telecommunications or Low-Voltage Unrestricted as issued by the State Construction Industry Licensing Board of Low-Voltage Contractors).
- C. Contractor shall submit a copy of a BICSI (Building Industry Consulting Service International) certificate certified and a RCDD (Registered Communications Distributions Designer) certificate.
- D. Comprehensive list of references: Attach a detailed list of references along with contact person, dates of work, mailing address, telephone numbers.
- E. Contractor must provide proof of installation in a minimum of five sites using an Category 6e, 350 MHRZ structured cabling system with 300 or more active (working) nodes installed.
- F. Acceptable Dealer/Representatives for Structured Cabling Systems:

Busker Communications  
Bobby Busker  
5865-F Oakbrook Parkway  
Norcross, GA 30093  
Phone: 770-417-1604  
Fax: 770-417-1747  
Email: [bbusker@bellsouth.net](mailto:bbusker@bellsouth.net)

NetPlanner Systems, Inc  
Mike Dycus  
3284 Medlock Bridge Road  
Norcross, GA 30092  
Contact: Mike Dycus  
Phone: 770-662-5482  
Fax: 770-441-3773  
Email: [mike.dycus@netplanner.com](mailto:mike.dycus@netplanner.com)

Tech Optics  
Terry Maynard  
463 Bankhead Hwy.  
Winder, GA 30680  
Phone: 770-867-1777  
Fax: 770-868-0111  
Email: [terry@techoptics.net](mailto:terry@techoptics.net)

Georgia Cabling and Electric  
5805 Peachtree Corners East, Suite B  
Norcross, GA 30092  
Phone: 770-448-3908  
Email: [georgiacable.com](mailto:georgiacable.com)

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. The acceptable manufacturers noted shall be installed by the authorized local factory dealer/representative for that product.
- B. The contractor shall hold a current Georgia low voltage contractor's license and RCDD certificate. Any other interested parties shall submit a company resume showing years in business, certification stating that he is an authorized representative for the manufacturer of the equipment he is submitting for approval and that he maintains a fully equipped and stocked service shop and shall respond to service calls within 12 normal working hours, list of key personnel, copies of appropriate licenses and list of recently completed jobs.
- C. Acceptable Manufacturer's: AMP, Panduit or Ortronics structured cabling systems. The structured cabling solutions must be "end-to-end" and covered under the manufacture's warranty as a complete system. Mixed manufactures under different warranties are not acceptable.

### 2.02 COMMUNICATION OUTLET SPECIFICATIONS

- A. Provide communications outlets (jacks for data/voice) as detailed on the drawings.
- B. Outlet faceplate for this arrangement shall be configured in the following fashion:

1. The jacks used shall fit properly in the outlet openings of the faceplate. The jacks used shall be capable of supporting LAN data rates of 350 MHz and also conform to parameters set in TIA/EIA 568, TSB36 and TSB40A.
2. Any vacant faceplate or communication outlet position shall be reserved for future growth and should have a dust cover/blank inserted.

## 2.03 HORIZONTAL CABLING WIRING SPECIFICATIONS

- A. This section covers the cable from the communications outlet to the patch panel. These cables shall be Category 6e 350 MHz, Plenum-rated, Unshielded Twisted Pair cable. Each cable shall be placed in a "point-to-point" fashion from the outlet to the wiring closet for each communications outlet needed. There shall be no intermediate splices or cross connects in these cables.
- B. The cable shall meet or exceed the following requirements:
  1. TIA/EIA 568 "Commercial Building Wiring Standard," Horizontal Cable Section.
  2. TIA/EIA TSB-36 "Technical System Bulletin Additional Cable Specifications for Unshielded Twisted Pair Cables, "Category 6e."
  3. Proposed ANSI X3T9.5 Requirements for UTP at 350 MHz.
  4. Certified Level 6 Cable under UL's LAN Cable Certification Program.
  5. IEEE 802.3
  6. ICEA S80-576
  7. UL Subject 444
  8. PUB 48007
  9. TA-TS000133
  10. National Electric Code - Article 800
- C. Provide 12 strand, 50/125 micron, *plenum rated cable with 6 multimode strands* to each IDF closet from the MDF. All fibers must be housed in rack mounted fiber enclosures. All fiber shall be terminated with SC fiber connectors and certified with a db loss meter. Provide two SC-to-LC MM fiber jumpers (2 meter) for each closet requiring fiber.

Fiber must be installed in 1" plenum rated innerduct or interlock jacket.

## 2.04 DATA PATCH PANEL SPECIFICATIONS

- A. This section covers the termination hardware located in the IDFs. The termination hardware shall provide the capability to patch connections between ports on the LAN hardware and the horizontal cables to the outlets.  
(electronics by owner, N.I.C.)
- B. The Patch panels shall be Category 6e, 350MHz modular jack panels.

- C. The termination hardware shall be located on ONE wall mounted rack in the IDF ROOM. The configuration of the patch panels shall be in an agreement that minimizes patch cord lengths. Provisions for cable management (organization of horizontal cable and patch cords) on the rack should be included.
- D. Potential horizontal cables to the outlets will be directly connected to 110 insulation displacement hardware associated with each jack on the patch panel. The jacks on the patch panel shall be wired to the EIA 568B wiring standard.
- E. Category 6e, 350 MHz factory-built, manufacturer tested patch cords shall be provided for each cable installed. Patch cords should be from the same manufacturer as the structured cabling solution.
- F. Provide 19" wide open racks suitable for mounting patch panels and LAN hardware in each IDF location. Furnish with plexiglass front door and front and rear vertical mounting rails. The racks should include vertical wire management devices on each side as well as horizontal wire management devices between each patch panel. Height of rack shall include all data/intercom wiring and owner furnished switch and UPS.

## 2.06 CONDUIT, RACEWAY, AND BACKBOARDS

- A. Backboard: Provide 3/4", trade size a-c plywood backboard as described in section 16000 of the specifications. Mount two sheets, 8 feet high and rigidly fasten plywood to wall to ensure that it can support attached equipment. Communications equipment backboards should be painted with a fire resistant, washable, low gloss paint the same color as the walls and installed in a timely manner so that final terminations of telephone (BellSouth) and coax cable (Adelphia) can be completed.

## PART 3 - EXECUTION

### 3.01 PULL AND JUNCTION BOX COVER IDENTIFICATION

- A. See color coding requirements in section 16000 of the specifications.

### 3.02 LABELING

- A. System shall be completely labeled, with circuit numbers indicated on the patch panel and communication outlets. Provide a list indicating circuit numbers installed to each space. Faceplate must have protective covers that will allow for a permanent label solution. "Stick-on" labels of any kind are not acceptable.
- B. Number each jack as follows:

MDF/IDF number + Patch Panel letter + Port number

### 3.03 TESTING AND CERTIFICATION

- A. Testing copper distribution systems are crucial in assuring the overall integrity and satisfactory performance of the network. Test results quantify system quality, identify system faults, and establish the baseline accountability performance of the system. Proper testing also maximizes the longevity of the system, minimizes downtime and maintenance, and facilitates system upgrades or reconfiguration.
- B. The Contractor shall provide proof of communications wiring systems certification and testing certification.
- C. All data wiring and terminations shall be tested and must pass EIA/TIA standards for Category 6e, 350 MHz wiring.
- D. All test results must be printed and provided to the owner in CD-ROM and/or floppy format and show the following results:

Impedance (TDR)  
Cable Length  
Attenuation  
Near End Cross Talk (NEXT)  
Line Mapping  
DC ohms  
OTDR

### 3.04 GUARANTEES

- A. All communication outlets wired and serviceable must be tested and certified in compliance with the ANSI/IEEE 802.3 and EIA/TIA 568 Category 6e, 350 MHz specifications. Testing must be "end-to-end". Test results shall be forwarded to Architect a minimum of one week prior to final inspection.

END OF SECTION

SECTION 16750 - INTEGRATED ELECTRONIC COMMUNICATIONS NETWORK

PART 1 – GENERAL

1.1 RELATED DOCUMENTS & WORK SPECIFIED ELSEWHERE

- A. The conditions of the General Contract (General, Supplementary, and other Conditions) and the General Requirements are hereby made a part of this Section.
- B. All bids shall be based on the expansion of the existing district's Intercommunication and must be compatible with the current Rauland-Borg and Sielox Systems - No Exceptions. Equipment as specified herein. The catalog numbers and model designations are that of the Rauland Borg and Sielox.
- C. The work in this section is related to the work specified in the following sections: Section 16050 Basic Materials and Methods
- D. The drawings and general provisions of the Contract Documents apply to this Section.
- E. Integration of the intercommunications system to the school district's telephone system. (SIP TO SIP INTEGRATION)
- F. Interconnect the fire alarm system to the intercommunications system such that upon activation of any initiating device, a preset audible alarm will be sent to all intercom speakers. In addition, the contractor shall furnish and install all controls necessary between the two systems such that upon silencing the alarm on the fire alarm panel, it automatically silences the MPEG file in the intercom system.
- G. CABLE REQUIREMENTS: The wiring systems specified in these guidelines are based upon requirements and recommendations of the IEEE, ANSI, EIA/TIA 568/569, and TSB 36 & 40, and BICSI for horizontal premise wiring. All products used shall be UL listed and meet applicable local and state codes and must match the current Dade County Schools standard.
- H. Copper Cable: Unshielded Twisted Pair (UTP) with a 24 AWG cabling must be used for the horizontal wiring from the MDF, IDF, or CP to the individual communications outlets.
- I. Not included in this Section –The owner and data network contractor shall provide: Racks, Cable Management. Provide fifteen (15) rack units of space in each MDF and IDF's for communications equipment. See drawing for port count per MDF-IDF's and rack space needed.
- J. The communication contractor shall provide Patch Panels, Patch Cables, and Data Switches, and Data Cabling from the MDF and IDF(s) to each data cable drop in the classroom or office. The data cable drop must be terminated in the middle of the room in each location shown on the drawing. Each data cable drop shall be labeled at both ends, patch panel, ceiling tile grid next to the speaker and tested. A service loop of five feet from the top of the grid for classroom and offices. Cable color shall meet the Dade County Schools standards.

1.2 SUMMARY

- K. This section includes a fully operational IP platform for a district-wide and internal school communications system incorporating school safety notifications and general communications including but not limited to, the following:

The platform shall provide complete internal communications employing state of the art IP Technology, including the minimum functions listed.

- a. Two-way internal intercommunications between staff locations and classrooms.
- b. Scheduled bell events.
- c. An emergency announcement that will override any pre-programmed zones assuring that all Emergency/Lockdown/Etc. are heard at each speaker location.
- d. The capability of prerecording emergency announcements that can be activated by a simple Soft Key or via a dedicated push button.
- e. Atomic Time Synchronization with Class Change Tones utilizing multiple, programmable schedules for each zone.
- f. District wide emergency, group, all school, and zone live voice paging.
- g. District wide emergency, group, all school, and zone paging for pre-recorded audio tones, music and voice.
- h. Web-based user interface.

The system shall support a minimum of 1000 level priorities, which shall be user-definable, allowing each end point to place a minimum of 5 different priority calls at the same time.

Any authorized administrator shall be able to call from outside the school into any classroom, zone, or the entire school directly via the School District supplied SIP (Session Initiation Protocol) enabled Telephone Network. This shall allow remote monitoring, call-in annunciation and two-way conversation from outside the facility as well as paging into the system. Compliance with NEMA Standard SB-40 for emergency communications in K-12 Schools.

Authorized system users shall be able to create a minimum of twenty (20) automated sequences with emergency instructions, tones, e-mails, and relay activations and replay them.

Automated message strings shall be manually initiated from single-button access on the console, on a SIP connected telephone, a panic button, from the web interface or via an interface with third-party systems.

Paging and two-way intercom features shall be accessible from any system console or SIP connected telephone for each campus.

The platform shall synchronize its system time to the network timeserver or a web-based time server.

Each single campus installation shall be locally survivable for intercom, paging, bells, and emergencies such as lockdown, even when the district connection is unavailable.

This specification establishes a minimum level of quality, features, and performance for individual components as well as the integrated system.

### 1.3 DEFINITION OF TERMS

- L. Installer(s): Shall refer to the person, persons or company who or which contracts to perform the work specified herein.

### 1.4 SUBMITTALS

- M. Product data for each component.
- N. Shop Drawings: Prior to proceeding with the work, provide detailed equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components and location of each field connection and a complete schedule of all equipment and materials with associated manufacturers cuts sheets which are to be used.

Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Identify terminals to facilitate installation, operation and maintenance. Artwork drawings and lists are indicating proposed nameplate nomenclature and arrangements for control panels and plug panels prior to fabrication reflecting equipment used. Each drawing shall have a descriptive title and all sub-parts of each drawing shall be labeled. All drawings shall have the name and locations of the project, Systems Contractor's name in the title block. Details and descriptions of any other aspect of the system, which must differ from the contract documents due to field conditions or equipment furnished.

- O. FCC Approval: The system shall be approved for direct interconnection to the telephone utility under Part 68 of FCC rules and regulations. Systems that are not FCC approved or utilized as an intermediary device for connection will not be considered. Provide the FCC registration number of the system being proposed as part of the submittal process.
- P. Product Certificates: Signed by manufacturers of equipment certifying that products furnished comply with specified requirements.
- Q. Installer Certificates: Signed by manufacturer certifying that installers comply with requirements.
- R. Manufacturer Certificates: Signed by manufacturers certifying that they comply with requirements.
- S. Maintenance Data: For equipment to be included in maintenance manuals specified in Division 1.
  - a. Record of Owners' equipment-programming option decisions.
  - b. All instructions necessary for proper operation and manufacturer's instructions.
  - c. "Proof of Performance" information.
  - d. Manufacturer's maintenance information.
  - e. Copies of non-proprietary computer programs and system set up disks documenting all programmable features of the installed system.
- T. Record Drawings: Prior to final acceptance, provide three (3) complete sets of drawings indicating all cable numbers and construction details in accordance with the actual system installation. Revise all shop drawings to represent actual installation conditions. These Record Drawings will be used during "Final Acceptance Testing."
- U. System Training: Submit the following information describing the training programs and system trainers as outlined in paragraph 1.6 of this specification and under Division 1 specifications. (12 hours of training 3 site visits within the first year of operation)
  - a. Include a preliminary staff development training program in the outline form for review and approval by the owner's representative.
  - b. Include a current copy of the trainer's certification from the manufacturer that certifies and identifies the trainer(s) who are eligible to provide training and support for the project.
  - c. Include a current copy of the trainer's need's assessment form which will be reviewed with the owner's designated representative for the system's preliminary system programming and configuration.
  - d. Include copies of all documentation used to identify for the owner those participants attending and completing the training programs.

## 1.5 QUALITY ASSURANCE



- V. Installer Qualifications: An experienced installer who is an authorized representative of equipment manufacturer for both installation and maintenance of equipment required for this Section. Provide the following within thirty (30) days after notification to proceed:
- W. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- X. Comply with NFPA 70
- Y. Comply with NEMA Standard SB-40 for Emergency Communications in K-12 schools.
- Z. Comply with UL 60950.

#### 1.6 IN-SERVICE TRAINING

- AA. The contractor shall provide and implement a complete and comprehensive staff training program for all administrators, facility staff members and teachers. This mandatory training program will provide school staff with a full understanding of how to utilize and adequately operate all functions.
- BB. The training program shall be implemented by a staff member/trainer employed by the contractor. The trainer must be factory certified to provide training on their product.
- CC. All staff development training is to be coordinated through the owner's designated representative. As training sessions are completed, the trainer will provide the school's administrative staff and school district's staff a document listing all of the team and faculty members who attended, received and completed the training program.

#### 1.7 WARRANTY

- DD. Provide a manufacturer's five-year warranty of the school communications network equipment against defects in material and workmanship. This warranty will cover all electronic equipment, as well as speakers, clocks, any field devices and call-in switches. If any defects are found within the warranty period, the defective equipment shall be replaced at no cost. Five years warranty shall be provided for labor.
- EE. The statement of the warranty shall be provided on the manufacturer's stationery. The standard five-year warranty is an essential element in establishing a standard in quality. Manufacturers who circumvent the five-year warranty by offering special "extended warranties" that are not part of their standard published warranty will not be accepted.
- FF. The contractor shall respond, excluding weekends and holidays, within 24 hours to any warranty service calls. If equipment cannot be repaired within 24 hours of the service visit, the contractor shall provide "loaner" equipment to the facility at no charge.
- GG. Make available a service contract offering continuing factory authorized service of the system after the initial warranty period.

#### 1.8 ACCEPTABLE MANUFACTURERS

- HH. The equipment model numbers specified herein are that of the Rauland and Sapling. The intent is to establish a standard of quality, the standard of equipment function, and features. It is the responsibility of the bidder to ensure that the proposed product meets or exceeds every standard set forth in these specifications. Failure to provide the identical functions of the existing district wide integrated communication system will result in the removal of the system at the end of the project and replace it at the contractor expense.

The functions and features specified are vital to the operation of this facility; therefore, inclusion in the list of acceptable manufacturers does not release the contractor from strict compliance with the requirements of this specification

#### **Existing Facility Upgrade – Rauland TCU Zone Paging & Sielox Systems**

Expand the existing Rauland TCU Zone Paging and Sielox Systems to provide coverage in the new addition. Abandon any cooper between outlying buildings or portable classrooms.

TCU Zone Paging manufactured by Rauland-Borg Corp.  
Sielox CLASS System

## **PART 2 - PRODUCTS**

### **2.1 SYSTEM REQUIREMENTS**

- A. The platform shall utilize state of the art IP Technology for Call-in Notification, School Safety Paging, and Evacuation Tones, Atomic Time Synchronization, Class Change Tones utilizing multiple, programmable schedules for each zone. Two-way hands-free Internal Intercommunications, Paging and Program Distribution. The system shall be easy to learn and operate. All standard programming shall be web-based and user-friendly to allow the system administrator the ability to program system features easily.
- B. The Sielox CLASS expansion shall provide an easy-to-operate graphical interface for security operators while performing complex crisis management, access control, security management and reporting functions.
- C. Operators shall be allowed to configure reports via browser specifically for devices, events, actions and messages based on time of day, day of week and weeks of year.
- D. The CLASS report feature shall allow a range of audit reports with date and time:
- E. Location status change, Chat messages from initiator or responder, Email/text alerts, Alert level changes, Clear location status (room clearing), Ability to recreate the sequence of events
- F. Provide a complete and satisfactorily operating district/school communications and district/school safety system as described herein, using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.

- G. The platform shall be a single electronic system consisting of a minimum of 10 intercom channels for each campus, (classroom) IP speaker modules and call-in switches, IP Zone Modules connecting corridor speakers, inside and outside horns, IP Administrative Consoles, SIP-enabled PBX integration and district-wide integration for paging, emergency notifications, calendar scheduling and configuration.
- H. Each Classroom shall be provided with an IP Speaker module interface and up to 5 different call-in switches, each with their annunciation path and priority. The ability to monitor the is device the operation and report via e-mail or text any failures.
- I. Call-ins may automatically annunciate (display of priority and location) to administrative consoles, and SIP enabled phones and outside phones.
- J. Call-ins shall be programmed to automatically change priority and annunciation route based on the age of call-in and priority.
- K. Call-ins may have priority and annunciation routing changed by user action from a console or SIP-enabled phone.
- L. Call-in annunciation routing shall include playing pre-recorded audio over speakers, sending a pre-configured e-mail and activating relays.
- M. The platform shall lend itself to expansion by the simple addition of hardware modules.
- N. The platform shall directly connect to the WAN/LAN without the need for a separate server at each school location. Configuration, including bell schedules, calendars, and emergency sequences, can remotely be created, changed, stored and downloaded to the system by an authorized user from a browser-based interface.
- O. The platform shall provide the ability to initiate school safety paging announcements, evacuation tones and take cover tones from any telephone or connected web-browser within the facility or outside the facility to any other location within the facility or district.
- P. The platform shall provide the ability to selectively communicate or monitor individual classrooms in emergency situations from any telephone within the facility or outside the facility to any other location within the facility. All communication within the classroom shall be hands free and will not require any interaction by the classroom user.
- Q. The platform shall provide classroom users the ability to confirm that they have safely secured their classrooms during lockdown with a single button press.
- R. IP-addressable and POE powered speaker modules for individual rooms shall be system programmable and may be assigned any two, three, four, five or six-digit number as well as name and description. Any extension may be reassigned at any time.
- S. IP-enabled two-way voice communication shall be available from any provided telephone or administrative console through any IP Speaker on a campus. This shall allow hands-free communication to any classroom or any individual IP loudspeaker unit. A programmable pre-announce tone shall sound immediately before the intercom path is opened and a supervisory tone shall continue to sound at regular intervals when speaker monitoring is active, complying fully with all privacy legislation. Pre-announce tone and supervisory tones shall be disabled during designated emergencies, such as lockdowns, automatically.

- T. The platform shall allow users to configure multiple schedules per school, with a minimum of 500 unique events per the schedule and automatic Daylight Savings Time correction. A minimum of 5 schedules may be active on any given day for each campus. Users shall be able to select from 25 standard included tones as well as unlimited user created and uploaded audio files for class change signaling and messaging. In addition, scheduled events shall consist of relay actions, e-mail notifications and paging exclusions as system configuration changes. The platform shall allow control of the bell schedules via the district WAN/LAN without the need for a separate server at each school location. Bell schedules can be remotely created, changed, stored and assigned to calendar days for the local school by an authorized user from a browser-based interface.
- U. The platform shall allow users to configure multiple schedules per school, with a minimum of 500 unique events per the schedule and automatic Daylight Savings Time correction. A minimum of 5 schedules may be active on any given day for each campus. Users shall be able to select from 25 standard included tones as well as unlimited user created and uploaded audio files for class change signaling and messaging also, as system configuration changed. The platform shall allow control of the bell schedules via the district WAN/LAN without the need for a separate server at each school location. Bell schedules can be remotely created, changed, stored and assigned to calendar days for the local school by an authorized user from a browser-based interface.
- V. The platform shall be able to integrate with an existing PA system or operate as a fully independent IP solution. The platform shall be able to function in the combination of said configurations and allow for seamless communication within a school or district-wide, regardless of the type of setup used. The platform shall be scalable, with the ability to easily add, install, and configure additional equipment to a system.
- W. The platform allows for customization of preprogrammed sequences, used for emergencies, events, and everyday communications. Preprogrammed sequences can be activated from the push of a relay button, soft key of an administrative console, a dial string of a SIP phone, or a web browser configured to the district network. Sequences can be initiated automatically as part of a schedule or on the fly. Preprogrammed sequences can be customized to utilize any combination of audio tones, emails, relays, tone exclusions, swings, delays, duplex, SIP phone notifications, and program distribution. Audio tones can include customized audio files and voice messages recorded in any language. Uploaded audio tones and messages can be preprogrammed to announce repeatedly or individually, as part of a scheduled sequence or on the fly. Each school in a district can have its customized sequences and can be activated separately, in groups, or district wide.
- X. The platform allows for emergencies to be initiated in a drill environment, separate from real emergencies. Drill emergencies can be initiated from panic buttons, consoles, SIP phones, or a web browser.

## 2.2 EQUIPMENT AND MATERIAL

- A. Server Software – Rauland Model TCC2000SW (Existing at District)
  - 1. Provides district-wide paging, bell event scheduling, emergency notification, and configuration for the entire district.
  - 2. It provides the ability to configure the system and initiate system features per school and district-wide from a web-based interface.
  - 3. The software can sync system time to the Atomic Clock Signal or to the school's or district's network time server.
  - 4. The software will provide a web-browser to deliver district-wide emergency paging, pre-recorded messages and tones from any authorized computer in the facility or the

- district. The software must be capable of automatically notifying district personnel via the WAN of an alarm condition.
5. The software can automatically broadcast emergency instructions via associated system hardware throughout an entire district when an alarm (e.g., lockdown, lockout, security, fire) is initiated via the web-based interface. The emergency instructions are preprogrammed and require no user intervention. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
  6. The software can be installed in cloud, virtual, or physical server environments.
  7. The web-based user interface supports secure HTTP browsing.
  8. The server software supports encryption to ensure secure access.
  9. The software shall support any combination of VoIP Telecenter U Campus Controllers for a minimum of 1000 facilities.
  10. The software shall support a minimum of 50,000 IP Speaker Modules district-wide.
- B. VoIP Single Campus Controller – Rauland Model TCC2000 (Existing)
1. Provides call routing for paging and intercom for a single facility
  2. Connects to the district provided Telephone Network via a SIP connection.
  3. Supports a flexible numbering plan allowing two, three, four, five- or six-digit extensions.
  4. SIP interface to a district provided Telephone Network shall enable connected phones to display classroom call-ins, answer internal intercom call-ins, make pages, and change priorities of call-ins in progress...
  5. Direct Dialing, two-way amplified voice intercom between any provided telephone or administrative console and IP speaker without the use of a press-to-talk or talk-listen switch.
  6. Ability to place two levels of call-in from any call-in switch.
  7. The ability to answer intercom call-ins registered at administrative consoles and pre-selected telephones.
  8. The ability to automatically escalate incoming call-ins to an alternate telephone or group of telephones if they remain unanswered for a predetermined amount of time.
  9. The ability to manually upgrade an intercom call-in to an alternate telephone or group of telephones.
  10. The ability for classrooms to “check-in” via push-button when they have successfully secured their location during an emergency.
  11. Administrative console shall display locations that have not “checked-in” to confirm their secured location and provide hands-free audio monitoring and communication to unsecured locations.
  12. The controller shall not need a direct connection to any classroom via home run or distributed wiring. It shall communicate solely through the IP Network.
  13. Single-button access from any telephone on the system to distribute emergency announcements within the facility to all or select locations equipped with speakers. Emergency announcements originating from any assigned administrative phone shall have priority over all regular system functions.
  14. Ability for administrative consoles and connected phones to selectively monitor audio at any two-way speaker during an emergency.
  15. Stores a minimum 48 hours of Bell Event Schedules, all emergency notification sequences as well as facility wide configuration.
  16. The system can sync system time to the Atomic Clock Signal or the school’s or district’s network time server.
  17. System’s SIP Interface shall provide:
  18. Audio paging access from any telephone to any single intercom speaker, zone (group) of intercom/paging speakers or all speakers/paging horns throughout the entire facility.

19. Ability to answer a call-in directed to that SIP extension.
  20. Ability to upgrade a call-in directed to that SIP extension
  21. Single-button access from any telephone on the system to initiate alarm signals within the facility to all or select locations equipped with speakers. A minimum of 25 separate distinct alarm signals shall be provided. Alarm signals originating from any assigned administrative telephone shall have priority over all regular system functions.
  22. Ability to initiate school-wide emergencies, including lockdown and evacuate sequences.
  23. The system will have the ability to utilize a web-browser and a USB microphone connected to the PC to deliver district-wide live emergency paging, pre-recorded messages and tones from any authorized computer in the facility or district. The system must be capable of automatically notifying district personnel via the WAN of an alarm condition.
  24. The system can automatically broadcast emergency instructions throughout an entire campus when an alarm (e.g., lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions are preprogrammed and require no user intervention. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
  25. IP Addressable Modules: - 1. The system shall provide multiple IP addressable modules for intercom, paging, and relay activation.
  26. All modules are POE 802.3af compliant.
  27. All Modules support DHCP
  28. All Modules connect to the network with a single RJ-45 connector
- C. IP Addressable Zone Paging Module – Rauland Model TCC2022
1. Zone paging modules convert the IP-based audio to an analog line-level audio signal to drive the Audio/Program Amplifiers specified herein.
  2. Zone paging modules shall connect multiple speakers for district all page, all page, zone paging, bells, audio events, and emergency notifications.
  3. Zone paging modules shall be rack mounted in the MDF/IDF's using the Rauland Model TCC2099 Universal Rack Mounting Kit.
  4. Zone paging modules shall be able to belong to one or more of 100 independent zones for live paging, bells, pre-recorded audio and emergency notifications.
- D. Audio Paging/Program Amplifier(s)
1. The power amplifier(s) shall be provided to provide a minimum of 2 watts of power to all paging speakers and 15 watts of power to all paging horns.
  2. The maximum load on the paging/program amplifiers shall be 80% of the rated maximum output of the amps.
  3. Provide JBL CSA-Series to meet the above requirements.
  4. Programmable soft key access from any console on the system to initiate alarm signals within the school to all or select locations equipped with speakers. A minimum of 25 separate distinct alarm signals shall be provided. Alarm signals originating from any assigned administrative telephone shall have priority over all regular system functions.
  5. Programmable soft key access from any console to automatically broadcast page emergency instructions throughout an entire school when an alarm (e.g., lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions Tile Ceiling Mounted Intercom Speaker – Rauland Model BAFKIT2X2L8RJ
  6. Shall be a pre-assembled 2 foot by 2-foot lay-in speaker, baffle and back box assembly consisting of a premium 8 Ohm, 8" speaker, a perforated steel baffle with

- a white baked epoxy finish and an integrated back box that covers the full area of the baffle.
7. The speaker assembly shall include a female RJ-45 modular socket and mounting bracket to facilitate connection to the TCC2011A IP Speaker Module specified herein. Provide as indicated on drawings.
- E. Tile Ceiling Mounted Paging Speaker – Rauland Model BAFKIT2X2L
1. Shall be a pre-assembled 2 foot by 2-foot lay-in assembly complete with 8” full-range speaker, 25Volt line matching, rotary-select tap transformer, perforated steel baffle with a white baked epoxy finish and an integrated back box that covers the full area of the baffle.
  2. The speaker assembly shall have a pair of speaker wires through a hole suitable for a 3/4” conduit fitting as the connection point for twisted/shielded cabling to the Audio Paging/Program Amplifiers specified herein. Provide as indicated on the drawings.
- F. Tile Ceiling Mounted Paging Speaker with Volume Control – Rauland Model BAFKIT2X2LVC
1. Shall be a pre-assembled 2 foot by 2-foot lay-in assembly complete with 8” full-range speaker, 25/70Volt line matching transformer, perforated steel baffle with a white baked epoxy finish and an integrated back box that covers the full area of the baffle.
  2. The speaker assembly shall have a pair of speaker wires through a hole suitable for a 3/4” conduit fitting as the connection point for twisted/shielded cabling to the Audio Paging/Program Amplifiers specified herein.
  3. The front panel accessible volume control permits the end-user to adjust the loudness of the speaker to a comfortable level. Provide as indicated on the drawings.
- G. Gypsum Ceiling Mounted Paging Speaker Assembly – Rauland Model ACC1406
1. Shall consist of a high-efficiency loudspeaker (Rauland Model US0188) complete with a 25/70 Volt multi-tap line matching transformer mounted on a round white epoxy steel baffle (Rauland Model ACC1000). The recessed ceiling back box shall be an 8” round enclosure with a plaster flange mounting ring and a depth of 4-1/8” (Rauland Model ACC1110). Provide as indicated on the drawings.
- H. Recessed Wall Mounted Paging Speaker – Rauland Model US0188
1. Shall be an 8” permanent magnet seamless cone type with an additional cone provided to extend high-frequency response. It shall have a frequency range of 65-17,000Hz, an 8-watt program power-handling capacity and an axial sensitivity of 93db at 1 watt with a 1-watt input. Voice coil shall be 3/4” diameter with an impedance of 8 Ohms. The speaker shall be equipped with a multi-tap transformer (0.312, 0.625, 1.25, 2.5 and 5 watts) at 25V and 70V.
  2. The recessed back box shall be of heavy gauge cold-rolled steel, spot welded for stability with a rust-retardant gray primer finish. Acoustically treat the interior to eliminate mechanical resonance. The backbox shall be 10-3/4” square by 3.75” deep (Lowell Model P68X).
  3. The baffle shall be constructed of 22-gauge cold-rolled steel that is zinc-treated to resist corrosion. The finish is baked, powdered white epoxy, which is virtually scratch- and mar-proof. (Lowell Model SG8-VP). Provide as indicated on the drawings.
- I. Surface Ceiling Mounted Paging Speaker – Rauland Model US0188
1. Shall be an 8” permanent magnet seamless cone type with an additional cone provided to extend high-frequency response. It shall have a frequency range of 65-17,000Hz, an 8-watt program power-handling capacity and an axial sensitivity of 93db at 1 watt with a 1-watt input. Voice coil shall be 3/4” diameter with an impedance

- of 8 Ohms. The speaker shall be equipped with a multi-tap transformer (0.312, 0.625, 1.25, 2.5 and 5 watts) at 25V and 70V.
2. The surface backbox shall be 18-gauge cold-rolled steel with an attractive white epoxy finish. The interior surfaces are jute-lined to prevent metallic resonance, vibration and provide proper acoustical results. The backbox shall be 12-1/2" square by 4" deep (Lowell Model CB84-SGVP).
  3. The baffle shall be constructed of 22-gauge cold-rolled steel that is zinc-treated to resist corrosion. The finish is baked, powdered white epoxy, which is virtually scratch- and mar-proof. (Lowell Model SG8-VP). Provide as indicated on the drawings.
- J. Recessed Wall Mounted Exterior Paging Speaker Assembly – Lowell Model P68X
1. The speaker shall be an 8" single cone driver with a moisture-resistant cone and a 10 oz. magnet. The cone is cotton cloth with a phenolic resin treatment and a double-dipped acrylic lacquer coating to provide superior protection in areas of high humidity. The speaker shall be Lowell Model 8C10MRB-T72. The recessed back box shall be of heavy gauge cold-rolled steel, spot welded for stability with a rust-retardant gray primer finish. Acoustically treat the interior to eliminate mechanical resonance. The backbox shall be 9.6" square X 3.75" deep. The baffle shall be vandal-proof, the faceplate constructed of a special aluminum alloy with a tensile strength of 44,000PSI. The baffle front is backed with a heavy gauge, perforated steel screen which protects the speaker. Provide tamper-resistant hardware. The Baffle shall be Lowell model SG8-VP. Provide as indicated on the drawings.
- K. Surface Exterior & Canopy Mounted Paging Speaker Assembly - Lowell model CB84-SGVP
1. The speaker shall be an 8" single cone driver with a moisture-resistant cone and a 10 oz. magnet. The cone is cotton cloth with a phenolic resin treatment, and a double-dipped acrylic lacquer coating to provide superior protection in areas of high humidity. The speaker shall be Lowell Model 8C10MRB-T72. Provide as indicated on drawings. The recessed back box shall be of heavy gauge cold-rolled steel, spot welded for stability with a rust-retardant gray primer finish. Acoustically treat the interior to eliminate mechanical resonance. The surface backbox shall be 11.5" square X 4" deep. The grille shall be 14-gauge steel, with a secondary steel barrier constructed of 22-gauge steel screen which protects the speaker. Provide tamper-resistant hardware.
- L. Surface Mounted Wall Speaker Assembly – Lowell BSG-8 Bi-Directional Wall Baffle
1. The bi-directional surface baffle for use with one 8 in. driver (not included) shall be Lowell Model No. BSG-8. The box shall be fabricated of 20-gauge steel (11.563 in. square x 4.250 in. projection) with two pre-mounted grilles, one front, and one rear. The assembly shall have a white powder epoxy finish.
  2. Material: Precision formed 20-gauge steel with welded corners
  3. Grille: Two pre-mounted steel grilles with welded speaker studs – White
  4. Size: 11.563 in. square x 4.250 in. deep
  5. Mounting Aids: Side opening for wire access (2 in. square) and punched to flush mount a standard E.O. b
- M. Cabling: West Penn, Mohawk, Quiktron, or as approved by the manufacturer.
1. Shall be West Penn, Mohawk, Quiktron, or as approved by the supplier. (All Cabling and patch and patch cords are to be green)
  2. W.P. #254245 (IP Speaker Homerun/ Console and NTP Sync.)
  3. W.P. #25292B (70V Paging Circuits)
  4. W.P. #25226B (24VAC Digital Clock Power)



5. 1-foot Cat5e (or better) patch cable from the IP Addressable Speaker Module to the Intercom Speaker.
6. 35-foot Cat5e (or better) patch cable from the IP Addressable Speaker Module to the Call-in Station Patch cables to interconnect IP Addressable Zone Paging, Auxiliary Input/output and Program Line Input Modules to the network at the head end.
7. All cabling and patch cables shall be plenum-rated.

#### PART 6 - EXECUTION

##### 6.1 EXAMINATION

- A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the School Communications and School Safety Network.
- B. Do not proceed until unsatisfactory conditions have been corrected.

##### 6.2 INSTALLATION

- A. General: Install the system following NFPA 70 and other applicable codes. Install equipment following the manufacturer's written instructions.
- B. Furnish and install all material, devices, components, and equipment for a complete and operational system.
- C. Impedance and Level Matching: Carefully match input and output impedance's and signal levels at signal interfaces. Provide matching networks where required.
- D. Control Circuit Wiring: Install control circuits following NFPA 70 and as indicated. Provide number of conductors as recommended by the system manufacturer to provide control functions indicated or specified.
- E. All housings are to be located as indicated.
- F. The contractor shall provide necessary transient protection on the AC power feed, all copper station lines leaving or entering the building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground.
- G. Wiring within Enclosures: Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars.
- H. Provide physical isolation from speaker-microphone, telephone, line-level wiring and power wiring. Run in separate raceways, or were exposed or in the same enclosure, provide 12-inch minimum separation between conductors to speaker-microphones, telephone wiring and adjacent parallel power. Provide physical separation as recommended by the equipment manufacturer for other system conductors.
- I. Identification of Conductors and Cables: Use color coding of conductors and apply wire and cable marking tape to designate wires and cables, so all media are identified in coordination with system wiring diagrams.
- J. Weatherproofing: Provide weatherproof enclosures for items to be mounted outdoors or exposed to the weather.

6.3 GROUNDING

- A. Provide equipment grounding connections for Integrated Electronic Communications Network systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.
- B. Ground equipment, conductor, and cable shields to eliminate shock hazards and to minimize to the greatest extent possible, ground loops, standard mode returns, noise pickup, cross talk, and other impairments. Provide a 5-ohm ground at the central equipment location. Measure, record and report ground resistance.
- C. Provide all necessary transient protection on the AC power feed and all copper station lines leaving or entering the building. Note on system drawings the type and location of these protection devices as well as all wiring information.

6.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a duly factory-authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing and adjustment of the system.
- B. Inspection: Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminals are identified.
- C. Testing: Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

6.5 FINAL ACCEPTANCE TESTING

- A. The Final Acceptance Testing shall be provided to the Owner, or the Owners designated representative only. Final acceptance testing to any other trade or service provider for the project will not comply with the requirements of this section.
- B. The contractor will provide a Final Acceptance Test record document signed by both the contractor and the Owner or designated Owner's Representative establishing the "In Warranty" date. The warranty period will not commence until the Final Acceptance Test is completed.
- C. Be prepared to verify the performance of any portion of the installation by demonstration, listening and viewing test, and instrumented measurements. Make additional adjustments within the scope of work and which are deemed necessary by the Owner because of the acceptance test.

6.6 COMMISSIONING

- A. The contractor shall train the Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the system. This training will be following the training as outlined in the In-Service Training Section of these specifications. In addition to the Training Materials provided, the contractor will also furnish Operators Manuals and Users Guides at the time of this training.

- B. Schedule training with Owner through the owner's representative with at least seven days advance notice.

6.7 OCCUPANCY ADJUSTMENTS

- A. The contractor shall provide Occupancy Adjustments following these specifications. A response scenario amenable to both the owner and the contractor will be established and followed for the first year of service.

6.8 CLEANING AND PROTECTION

- A. Prior to final acceptance, the contractor shall vacuum and clean all system components and protect them from damage and deterioration. All general areas within and around all equipment rack/cabinets in the facility will be swept, vacuumed, and cleaned up.

END OF SECTION