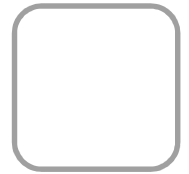




architecture



SET#

PROJECT MANUAL

SEDGWICK COUNTY SCADF OFFICE & ENTRY EXPANSION /REMODEL

BID PACKAGE

SEDGWICK CO BID# 19-0034

BID DOCUMENTS

SPECIFICATIONS

8 March 2019

SJCF Project: 5278.20

SECTION 00 01 07 - SEALS PAGE

SCHAEFER JOHNSON COX FREY ARCHITECTURE

ARCHITECTS



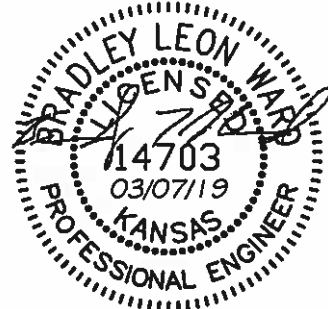
DUDLEY WILLIAMS AND ASSOCIATES, P.A.

STRUCTURAL ENGINEERS



MIDWEST ENGINEERING, INC.

MECHANICAL ENGINEERS



INTEGRATED CONSULTING ENGINEERS, INC.

ELECTRICAL ENGINEERS



EXPIRES: 04-30-2019

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Adult Detention Facility (ADF) Office & Entry Expansion/Remodel

INVITATION FOR BIDS

PROJECT: Adult Detention Facility (ADF) Office and Entry Expansion/Remodel
141 W. Elm st.
Wichita, KS 67203

COUNTY BID NUMBER: 19-0034

PRE-BID MEETING:

A pre-bid meeting will be held on site. Bidders are to meet at 141 W. Elm, beginning at 9:00 a.m. CDT on Thursday, March 21, 2019.

Attendance is not mandatory; however, this will be the only time to meet directly with County staff and the architect to answer questions concerning this project. General contractors are encouraged to have their subcontractors attend this meeting to view the site conditions.

Bidders are encouraged to examine bidding documents as early as possible. **In order to ensure each bidder has the most current information for bidding there is an established date and time for last questions to be asked. Bidders requiring clarification or interpretation of the Bidding Documents shall make such requests, in writing only, to Kristen McGovern, Senior Purchasing Agent, at kristen.mcgovern@sedgwick.gov no later than 5:00 p.m. CDT on Friday, March 29, 2019.**

RESPONSES TO INVITATION FOR BID:

Responses will be received in the Sedgwick County Purchasing Department, located in the Finance Department, Main Courthouse, 525 N. Main Street, Suite 823, Wichita, Kansas, 67203, until **1:45 p.m. CDT** on Tuesday, April 9, 2019. Late Bids will not be accepted and will not be considered for award recommendation.

BID RESPONSES WILL BE OPENED AT: 2:00 p.m. CDT on Tuesday, April 9, 2019.

This meeting will be held in the Finance Department, Main Courthouse, 525 N. Main, Suite 823, Wichita, Kansas, 67203. All interested parties are invited to attend this meeting, as bids/responses will be received, publicly opened and read aloud.

After review and appropriate approval, a contract will be awarded to the lowest responsive, responsible and best bidder meeting specifications and appropriately licensed to do the specified work outlined in these documents.

Plans and specifications are available in electronic form only and may be downloaded by clicking the following link, [Sedgwick County Construction Projects](#). Company information will be collected to generate a plan holder's list which will be updated weekly and available at the Adult Detention Facility (ADF) Office and Entry Expansion/Remodel section of the [current RFP/RFQ page](#). Plans are available for viewing only in the County Clerk's office, Main Courthouse, 525 N. Main, Second Floor, Wichita, Kansas, 67203.

There will be **NO** Bid Document Deposit for this set of Documents.

A RECOMMENDATION FOR CONTRACT AWARD:

will be made to the Board of Bids and Contracts at its regular meeting **at 10:00 a.m. CDT on April 11, 2019**, generally held in the County Commission Meeting Room located at 525 North Main, Third Floor, Wichita, Kansas, 67203, although this date or location could change.

CONTRACT AWARD:

Board of County Commissioners will consider award on **Wednesday, April 17, 2019, although this date could change.**

PROJECT SCOPE:

Expand the northeast portion of the Adult Detention Facility and renovate the lobby and some of the adjacent office spaces on the 1st and 2nd floors.

Adult Detention Facility (ADF) Office & Entry Expansion/Remodel

BIDDING DOCUMENTS:

1. Complete sets of Bidding Documents shall be used in preparing Bids.
2. Neither the Owner nor the Architect/Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
3. The Owner or Architect/Engineer, in making copies of the Bidding Documents available, do so only for the purpose of obtaining Bids on the work and do not confer a license or grant for any other use.
4. Bids shall include furnishing all labor, materials, equipment and performing the work for the above-described Project in strict accordance with the Bidding Documents and any Addenda.

DURING BIDDING PERIOD:

Inquiries regarding Bid Documents, Bid/Selection process or any requests for information about this specific project shall be directed in writing only to:

Kristen McGovern, Senior Purchasing Agent
525 North Main Street, Suite 823
Wichita, KS 67203
Telephone: (316) 660-7258 Fax: (316) 383-7055
E-mail: kristen.mcgovern@sedgwick.gov

All contact concerning this solicitation shall be made through the Purchasing Department.

Bidders shall not contact county employees, department heads, using agencies, evaluation committee members or elected officials with questions or any other concerns about the solicitation. Questions, clarifications and concerns shall be submitted to the Purchasing Department **in writing**. Failure to comply with these guidelines may disqualify the Bidder's response.

OWNER'S REPRESENTATION:

Owner's Representative for the duration of the Project:

Valerie Kaster, Project Services Manager
271 W. 3rd Street, Suite 325
Wichita, Kansas 67202
Telephone: (316) 660-9080 Fax: (316) 660-9868
E-mail: valerie.kaster@sedgwick.gov

Architect's Representative:

Justin Graham
SJCF Architecture
257 N Broadway
Wichita, Kansas, 67202
Telephone: (316) 684-0171
E-mail: jgraham@sjcf.com

BIDDER'S REPRESENTATION:

In order to induce the Owner to accept their Bid, in addition to and not in lieu of any other representations and warranties contained in the Bidding Documents, the Bidder represents and warrants the following to the Owner:

1. The Bidder and their subcontractors are financially solvent and possess sufficient working capital to complete the work, and perform all obligations hereunder.
2. The Bidder is able to provide the plant, tools, materials, supplies, equipment, and labor required to complete the work and perform the Bidder's obligations hereunder.

Adult Detention Facility (ADF) Office & Entry Expansion/Remodel

3. The Bidder will be authorized to do business in the State of Kansas, and will be properly licensed to do this work.
4. The Bid and execution of the Bidding Documents and the Bidder's performance thereunder are within the Bidder's duly authorized powers.
5. The Bidder has made an exhaustive study of the Bidding Documents; understands the terms and provisions thereof; and has sought or will timely seek any and all necessary clarifications prior to submitting the Bid; and that the Bid is made in accordance with the foregoing.
6. The Bidder has visited the Project and is completely familiar with the local and special conditions under which the work is to be performed and has correlated such knowledge with the requirements of the Bidding Documents.
7. The Bid is based upon the approved materials, systems and equipment described in the Bidding Documents without exception, including all warranties, coordination and components required to perform the work.
8. The Bidder certifies that their Bid is submitted without collusion, fraud, or misrepresentation as to other Bidders, so that all Bids for the Project result from a free, open and competitive bidding environment.
9. The Bidder possesses a high level of experience and expertise in the business administration, management, and superintendence of projects of the size, complexity and nature of this particular Project, and that the Bidder will work with the care, skill and diligence of such a contractor.
10. The Bidder acknowledges that the Owner is relying upon this Bidder's skill and experience in connection with the work being bid herein.
11. That complete sets of Bidding Documents were used in the preparation of the Bid and that neither the Owner nor the Architect is responsible for errors or misinterpretations resulting from the use of incomplete sets of such Documents.

The foregoing warranties are in addition to, and not in lieu of (A) any and all other liability imposed upon the Contractor by law with respect to the Contractor's duties, obligations and performance of the work and (B) any and all other warranties, representations and certifications made in the Bidding Documents. The Contractor's liability hereunder shall survive the Owner's final acceptance of and payment for the work. All representations and warranties set forth herein and in the Contract Documents shall survive the final completion of the work or the earlier termination of this Agreement.

Bid Guarantee:

1. Bid Security is required in the amount of at least 5% of the bid plus all additional alternates. In case of multiple prices in a bid or alternate, write for the maximum possible contract amount.
2. Bid Security can be in the form of a certified or Cashier's Check or Bid Bond acceptable to Sedgwick County. Checks are to be made payable to the Sedgwick County Clerk and drawn on a solvent Kansas bank or trust company. These checks or bonds will be retained by Sedgwick County until the purchase contract has been awarded.
3. Bid Bonds shall be written by a bonding agency approved by the United States Treasury Department and licensed to do business in the State of Kansas.
4. Bid Bonds shall be submitted on AIA Document A310, latest edition, as issued and approved by the American Institute of Architects.
5. Bid Security will be retained by the Sedgwick County Clerk until the Contract for the Project has been completed and is a guarantee that if awarded the Contract, the Bidder will enter into a contract and give bonds as required. In the event the successful Bidder fails to consummate a signed Contract, through no fault of the Owner, Bid Security shall be retained by the Owner as liquidated damages and not as a penalty.
6. Sedgwick County reserves the right to retain the Bid Security of the three (3) lowest Bidders until the successful Bidder has entered into a Contract or until 60 days after Bid opening, whichever is the shorter. All other Bid Securities will be returned as soon as practicable.

Sedgwick County is desirous of allowing as many Kansas vendors as possible the opportunity to participate, including minority owned, woman owned and small businesses, in the roles of general contractors and subcontractors. If your company does not fall into either of these categories, your efforts to contract with vendors who fall in these categories are appreciated.

Adult Detention Facility (ADF) Office & Entry Expansion/Remodel

General Contractor will be required to maintain a subcontractor worksheet throughout the project and will submit the worksheet to County staff at anytime requested but shall submit the worksheet at the completion of project.

END OF INVITATION FOR BIDS

Adult Detention Facility (ADF) Office & Entry Expansion/Remodel

INSTRUCTIONS TO BIDDERS

PROJECT: Adult Detention Facility (ADF) Office and Entry Expansion/Remodel
141 W. Elm st.
Wichita, KS 67203

COUNTY BID NUMBER: 19-0034

ARCHITECT: Justin Graham
SJCF Architecture
257 N Broadway
Wichita, Kansas, 67202

Bids shall be made in accordance with these Instructions to Bidders:

- A. Responses to this invitation will be accepted only from General Contractors who are licensed to do business in Sedgwick County.
- B. Applications will also be accepted from General Contractors who have applied to receive a reciprocal license.
- C. A copy of General Contractor's Certificate of Insurance will be required to be submitted with the Bid at the time the bids are due. Insurance policy will be due from the successful contractor as part of the required documents prior to issuance of the notice to proceed.
- D. Bidding Documents shall include the Invitation for Bids, Bid Form, construction drawings, proposed Contract Documents, including any Addenda issued prior to receipt of Bids, supplemental information and any additional information requested.
- E. Bids must be on a lump sum basis and shall be the Contract Amount.
- F. Bidder Qualifications: For the duration of the project, all Prime Bidders shall be located within Sedgwick County, Kansas or establish an office in Sedgwick County, Kansas, and may be required by the Owner to furnish information to support the Bidder's capability to fulfill the Contract if awarded the Contract. Such information does not need to be submitted with the Bid, but may be requested at the Owner's option. Such information may include, but not be limited to, the following:
 - 1. Proof of registration with the Kansas Director of Taxation by non-resident Bidders (K.S.A. 79-1009).
 - 2. Proof of registration with the Kansas Secretary of State by foreign corporations.
 - 3. List of projects of similar size and type the Bidder has constructed or in which the Bidder has been engaged in a responsible capacity.
 - 4. Evidence the Bidder maintains a permanent place of business.
 - 5. A current financial statement.

Examination:

- 1. BEFORE SUBMITTING A BID, each Bidder shall examine carefully all documents pertaining to the work and visit the site to fully inform himself of the condition of the site and the conditions and limitations under which the work is to be performed.
- 2. SUBMISSION OF A BID will be considered presumptive evidence that the Bidder has fully informed himself of the conditions of the site, requirements of the Contract Documents, and of pertinent national, state and local codes and ordinances, and that the Bid made allowances for all conditions, requirements and contingencies.

Adult Detention Facility (ADF) Office & Entry Expansion/Remodel

3. In reviewing these Documents, it is evident that certain information, if disclosed to the public, may jeopardize the security of Sedgwick County, and appropriate measures will be taken to maintain confidentiality.
4. **In order to ensure each bidder has the most current information for bidding there is an established date and time for last questions to be asked. Bidders requiring clarification or interpretation of the Bidding Documents shall make such requests, in writing only, to the Purchasing Agent no later than 5:00 p.m. CDT on Friday, March 29, 2019.**
5. Samples shall be submitted by the above referenced deadline to permit evaluation and notification of Bidders.
6. Any interpretation, correction or change of the Bidding Documents will be made by written Addenda. Interpretations, corrections, or changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon such interpretations, corrections, and changes.

Addenda:

1. DISCREPANCIES OR OMISSIONS in the documents will be clarified in the form of an electronic Addendum and will be posted on the County web site. Bidders finding discrepancies, omissions, or who are in doubt as to the meaning of any portion of the Contract Documents, should immediately request an interpretation from the Senior Purchasing Agent. In response, an Addendum will be issued and the contractor shall rely solely on information contained in the written Addenda about said discrepancy or omission. **Neither the Architect nor the Owner will be responsible for any other form of instructions or interpretations given to the contractor, either verbal or written.**
2. ADDENDA received by Bidders shall be acknowledged by same on their Bid Form.

Substitutions:

1. Each Bidder represents that their Bid is based upon materials and equipment described in the Bidding Documents.
2. No substitution will be considered unless written request has been submitted to the Purchasing Agent and the Architect, in duplicate, for approval by 5:00 p.m. CDT on Friday, March 29, 2019. Each such request shall include a complete description of the proposed substitute, drawings, cuts, performance or test data, or information necessary for a complete evaluation. If the Architect approves any proposed substitution, such approval will be set forth in an Addendum.

Preparation of Bids:

1. BIDS shall be made on unaltered Bid Forms furnished by the County, or detached from this Project Manual.
2. FILL IN all blanks on the Bid Form with ink or type. Blanks left on Bid Form may be cause for disqualification of Bidder.
3. SIGN BID FORM in longhand, with name typed below signature. Where Bidder is a Corporation, Bids must be signed with the legal name of the Corporation, followed by the legal signature of an officer authorized to bind the Corporation to a contract.
4. RECAPITULATION of work to be done shall not be included with any Bid.
5. Where so indicated by the makeup of the Bid Form, amounts shall be expressed in both words and figures, and in case of discrepancy between the two, the written amount shall govern.

Adult Detention Facility (ADF) Office & Entry Expansion/Remodel

Identification and Submission of Bid:

1. Contractor shall provide one (1) Original of the Bid Response Form, Bid Security and other supplemental information required to be submitted with the Bid.
2. All of the Bid Documents shall be enclosed in a sealed envelope with the notation "Bid Enclosed" on the face. The firm name and address, Bid number, Bid opening date, and Bid opening time shall be provided in the lower left-hand corner of the Envelope.

Modification and Withdrawal of Bid:

1. A Bid may not be modified, withdrawn or canceled by the Bidder during the stipulated time period that a Bidder's Bid Security is held following the time and date designated for the receipt of Bids. The Bidder so agrees in submitting his Bid.
2. WITHDRAWAL BEFORE BID OPENING: A Bid may be withdrawn at any time before Bid Opening, but may not be resubmitted. If a bidder withdraws a bid, as authorized in K.S.A. 75-6905, the awarding authority may require that such bidder shall not be allowed to perform any work on the project through subcontract agreements or by any other means including re-bids.
3. AFTER BID OPENING: No Bid may be withdrawn or modified, except where the award of contract has been delayed for more than 60 days.

In the event of an Award, the lowest, responsive, responsible and best bid price meeting the specifications will be required to enter into contract required for the Project. Said Bidder shall also provide a Performance Bond for the full amount of the contract. The Performance Bond, in the amount of 100% of the Contract amount, must be submitted within 30 calendar days after award of contract. Failure to return these Documents within the required time period may cause a cancellation of the Award.

Consideration of Bids/Selection Process:

1. Bids received will be opened and read aloud publicly.
2. Owner shall have the right to determine the acceptable Bidder on the basis of the sum of the Base Bid and the Alternates accepted.
3. The Owner will award a contract to the lowest, responsive, responsible and best Bidder provided:
 - a. The Bid conforms to and has been submitted according to the requirements of the Bidding Documents and includes the Certificate of Insurance including Contractor's General Automotive Liability, Workers Compensation Insurance and Owner's Liability Insurance.
 - b. The Bid is judged to be reasonable.
 - c. The Bid does not exceed the funds available.
 - d. The Bid complies with the Instruction to Bidders and Mandatory Requirements.
 - e. The completion time is satisfactory to the Owner.
 - f. Evidence of the experience, qualifications and financial responsibility of the Bidder and his Subcontractors and the time of completion are all satisfactory to the Owner.
 - g. The County reserves the right to reject Bidders in accordance with the Bidding Documents.

Adult Detention Facility (ADF) Office & Entry Expansion/Remodel

4. Bids will be screened by a Review Committee consisting of the Project Manager, Architect and the Purchasing Agent.
5. No negotiations, decisions, or actions shall be initiated by any firm as a result of any verbal discussion with the Owner or employee of the Owner before the opening of responses to the document.
6. The Owner shall have the right to waive any informality and/or irregularity in any Bid received.
7. The Owner shall have the right to reject any and all Bids.

Time for Completion and Liquidated Damages:

All Bidders are required to state on the Bid Form the time needed for all work under the general contract to be completed, which would yield their best Bid. Unless otherwise required, this time frame shall be stated in calendar days and shall represent the Contractor's commitment to complete the project on schedule.

The contractual period will begin with the issuance of Notice to Proceed and continue through completion of the project.

The Agreement will include a stipulation that liquidated damages will be assessed in the amount of \$132.50 per calendar day after Completion Date that the work is not substantially complete.

Upon satisfactory completion of the Contract, a formal CERTIFICATE OF PROJECT COMPLETION will be forwarded to the Contractor by the Project Architect. The date of substantial completion of the Project will be the starting date of the warranty period.

All work shall be in accordance with all Federal and State Laws, Local Ordinances and Building Codes, and the 2010 Standards for Accessible Design.

Taxes: Materials and equipment incorporated in the work are exempt from payment of sales tax under the laws of the State of Kansas.

Project Time Line:

The following dates are provided in addition to those previously stated to help interested contractors in planning participation in the project herein. The dates listed, however, are in no way guaranteed and are subject to change without notice.

Project out for bid – Thursday, March, 14, 2019

Pre-bid Meeting – Thursday, March 21, 2019 at 9:00 a.m. CDT

Last questions received – Friday, March 29, 2019 at 5:00 p.m. CDT

Last Addendum Issued – Thursday, April, 4, 2019 at 5:00 p.m. CDT

Bids Due in Purchasing – Tuesday, April, 9, 2019 at 1:45 p.m. CDT

Bid Opening – Tuesday, April, 9, 2019 at 2:00 p.m. CDT

Board of Bids and Contracts – Thursday, April 11, 2019 at 10:00 a.m. CDT

Board of County Commissioners – Wednesday, April 17, 2019 at 9:00 a.m. CDT

Notice to Proceed:

No work shall commence until the Owner issues a Notice To Proceed, and a Notice To Proceed will not be issued until all of the following are delivered to the Project Services Office, 271 W 3rd St., Suite 325, Wichita, Kansas, 67202, by the selected vendor:

1. The Contract signed by the representative with authority and ability to do so.

Adult Detention Facility (ADF) Office & Entry Expansion/Remodel

2. Performance and Statutory Bonds with the attached powers of attorney. Attach the receipt of the Clerk of the District Court to the Statutory Bond.
3. List of subcontractors and supplier's proof of a valid Contractor's license from the jurisdiction in which the work is being performed for both contractor and applicable sub-contractors is required.
4. Corporate Resolution of authority to sign and deliver the Contract Documents, executed by the Corporation's Secretary or Assistant Secretary and dated before all other dated submittals.
5. Domestic (Kansas) corporations shall furnish evidence of good standing in the form of a Certificate signed by the Kansas Secretary of State. Foreign (non-Kansas) corporations shall furnish evidence of authority to transact business in Kansas, in the form of a Certificate signed by the Kansas Secretary of State.
6. Construction Schedule with major milestones identified.
7. Insurance Certification for Payment.

Such documents must be delivered within ten (10) days of the Owner's written notification to the successful Bidder. If they are not delivered within such time then the Bidder will be deemed to have abandoned its contract with the Owner, and the Owner will award a contract to the next lowest and best Bid.

1. The successful Bidder shall not make claim either for time or money against the Owner for labor or materials performed or delivered prior to issuance of the Notice to Proceed.
2. The County's responsibility to issue a Notice To Proceed is expressly conditioned on the Contractor's timely execution and delivery of such documents.
3. The County intends to issue a Notice To Proceed within 30 days of receipt of Bids.
4. Bidders shall also note that the Work cannot begin until after a State of Kansas Sales Tax Exemption Certificate has been provided by Sedgwick County and affixed to the Purchase Order and the Notice to Proceed.
5. Contractor must submit Insurance Policy.

END OF INSTRUCTIONS TO BIDDERS

Adult Detention Facility (ADF) Office & Entry Expansion/Remodel

BID FORM

BID PROVIDED BY:

(Company Name)

I have received the Bid Documents, Specifications, and Construction Documents, collectively known as the Contract Documents for Construction of the

Adult Detention Facility (ADF) Office & Entry Expansion/Remodel

COUNTY BID NUMBER 19-0034

as prepared by the Architect, SJCF Architecture:

In submitting this Bid, I agree:

1. To hold my Bid open for 60 days after the date of this Bid.
2. To enter into and execute a Contract, if awarded on the basis of this Bid, and to proceed in accordance with the requirements of the General Conditions and Contract Form.
3. To provide all labor, materials, equipment, tools of trades and labor, accessories, appliances, warranties and guarantees, and to pay all royalties, fees, permits, licenses and applicable taxes necessary to complete the work in accordance with the proposed Contract Documents.
4. To remove and haul away from the construction site any and all debris arising from this contract and to assume sole liability for all removal, handling, and dumping of debris.
5. To comply with any and all local, state, federal or other governmental laws, rules and regulations with respect to the transportation, disposal, and dumping of debris and other excavated materials and Contractor shall secure any and all necessary permits and approvals incident to said transportation, dumping and disposal.
6. To further agree to indemnify and hold the Owner and Designer harmless from any and all claims and/or damage of any kind whatsoever as a result of the Contractor's performance of this Contract.
7. That attached to this Bid is one copy of the Certificate of Insurance including Contractor's General Automotive Liability, Workers Compensation Insurance and Owner's Liability Insurance.
8. **CALENDAR DAYS:**
The Undersigned agrees to reach substantial completion of the Work in _____ consecutive calendar days from the date of Notice to Proceed.

The Undersigned agrees to reach final completion of the Work in _____ consecutive calendar days from the date of Substantial Completion.

Total Calendar Days _____

Adult Detention Facility (ADF) Office & Entry Expansion/Remodel

9.

BID:

Base Bid:

To complete the Base Bid Work, in the time stipulated, in accordance with the Bidding Documents for the lump sum price of:

Dollars (\$_____).

Unit Prices:

1. Cost per cu. yd. (add) for piles deeper than bottom of pile elevations scheduled.

Dollars (\$_____).

2. Cost per s.f. for replacement of existing saturated gypsum or lightweight concrete and saturated insulation beneath new roofing membrane (thicknesses vary - avg. 5" combined insulation and topping).

Dollars (\$_____).

Break-Out Pricing:

Pricing on the following two items need to be included in your base bid total. The following information is to assist in the allocation of funding for these items from separate sources.

1. Cost to repair or replace the Paralleling Control System at the Adult Detention Facility south generators as indicated on electrical drawings and specifications.

Dollars (\$_____).

2. Cost to remove and replace roofing down to the gypsum/concrete topping on the central and south portions of the Adult Detention Facility.

Dollars (\$_____).

10.

ADDENDA:

The Bidder acknowledges receipt of the following numbered Addenda:

None () #1() #2() #3 () #4() #5()

11.

AGREEMENTS:

The Undersigned agrees to the following terms and conditions:

- a. An incomplete Bid, or other information not requested which is written on this Bid Form, may be cause for rejection.
- b. Read the Invitation for Bids and the Instructions to Bidders carefully.
- c. The Owner reserves the right to reject any or all Bids and to waive all technicalities should such action be deemed to be in the best interest of the Owner.
- d. This Bid may not be withdrawn for a period of 60 calendar days following the receipt and opening.
- e. Failure to acknowledge receipt of any Addendum issued may be cause for Bid rejection.
- f. In the event that changes to the work are required, the undersigned agrees that ten percent (**10 %**) total between General and Subcontractors of his net costs shall be added thereto for Overhead, Profit and General Requirements (including but not limited to, Insurance and Bonds).

Adult Detention Facility (ADF) Office & Entry Expansion/Remodel

12. **MAJOR SUBCONTRACTORS:**

The Undersigned acknowledges the following named major subcontractors are to be used for their respective division of work. Contractors shall identify by type, any disadvantaged, minority and women-owned businesses used as a subcontractor for this project.

Subcontractor: _____

Address – City, State, Zip: _____

Additional, if necessary:

13. **DECLARATIONS:**

The Undersigned hereby declares he has carefully examined the Drawings and Specifications, has visited the actual location of the work, has satisfied himself as to all conditions and understands that, in signing this Bid Form, he waives all right to plead any misunderstandings regarding same and agrees to be bound by the provisions of said Drawings and Specifications and all statements made therein.

The Undersigned proposes to enter into Contract and to furnish and pay for the specified Bonds and other required Documents within 10 working days after notification of award of Contract.

14. **FIRM IDENTIFYING INFORMATION:**

FIRM NAME _____

CONTACT _____

SIGNATURE _____ TITLE _____

PRINT NAME _____

ADDRESS _____ CITY/STATE _____ ZIP _____

PHONE _____ FAX _____ HOURS _____

COMPANY WEBSITE ADDRESS _____ E-MAIL _____

NUMBER OF LOCATIONS _____ NUMBER OF PERSONS EMPLOYED _____

TYPE OF ORGANIZATION:

Public Corporation ___ Private Corporation ___ Sole Proprietorship ___ Partnership ___ Small Business ___

General Nature of Business _____

Manufacturer ___ Distributor ___ Retail ___ Dealer ___ Service ___

___ Not Minority/Caucasian (00) publicly traded companies and nonprofits are in this category

Minority Owned Business:

___ African American (05), ___ Asian Pacific (10), ___ Subcontinent Asian (15), ___ Hispanic (20),

___ Native American (25), ___ Other (30) - Please specify _____,

___ Not Minority/Caucasian – Woman Owned (50), ___ African American – Woman Owned (55),

___ Asian Pacific – Woman Owned (60), ___ Subcontinent Asian – Woman Owned (65), ___ Hispanic –

Woman Owned (70), ___ Native American – Woman Owned (75), ___ Other – Woman Owned (80)

Insurance registered in the State of Kansas with a minimum best rating of A-VIII: ___ Yes ___ No

Adult Detention Facility (ADF) Office & Entry Expansion/Remodel

15. **SIGNATURE AND SEAL:**

DATED THIS _____ DAY OF _____, 2019.

LEGAL NAME OF PERSON, FIRM OR CORPORATION

MAILING ADDRESS OF ABOVE

SIGNATURE

TELEPHONE NUMBER

FAX NUMBER

(Affix Corporate Seal here)

E-MAIL

REQUEST FOR BID CONDITIONS

In submitting a response to this Request for Bid, vendors hereby understand the following:

1. Pricing offered in the bid document will be provided to other local governments and governments whom Sedgwick County regularly enters into cooperative agreements.
2. Sedgwick County reserves the right to reject any and/or all bids and responses to these and/or related documents, to accept any item(s) in the bids, to waive any irregularity in the bids, and further if determined to be non-responsive in any form, or if determined to be in the best interest of Sedgwick County.
3. Alternate bids (two or more bids submitted) will be considered for an award. Sedgwick County reserves the right to make the final determination of actual equivalency or suitability of such bids with respect to requirements outlined herein. The bids submitted, and any further information acquired through interviews, will become and is to be considered a part of the final completed contract. If there is any variance or conflict, the bid specifications will control.
4. Bidders MUST return completed copies of the entire document to the Sedgwick County Purchasing Department, 525 N. Main, 8th Floor, Suite 823, Wichita, KS 67203, on or before the date and time specified. Bids must be sealed in an envelope and marked with the firm name and address, bid number, bid opening date, and bid opening time. The time clock stamp, located in the Sedgwick County Purchasing Department will determine the time of receipt.
5. Bids submitted may not be withdrawn for a period of 60 days immediately following the opening of this Request for Bid. Prices MUST be free of federal, state, and local taxes unless otherwise imposed by a governmental body, and applicable to the material on the bid.
6. Sedgwick County interprets the term "Lowest Responsible and Best Bidder" as requiring Sedgwick County to: (a) choose between the kinds of materials, goods, wares, or services subject to the bid, and (b) determine which bid is most suitable for its intended use or purpose. Sedgwick County can consider, among other factors, such things as the availability of service(s), part(s) material(s) and/or supply(s), warranty, maintenance, freight costs, performance of product and labor cost of items upon which bids are received.
7. All requested information must be supplied. If bidders cannot respond to any part of this request, bidders should state the reason they cannot respond and note an exception. Bidders may provide supplemental information to assist Sedgwick County in analyzing its bid.
8. If the bidder refuses or fails to make deliveries of the materials within the times specified on the face of the Request for Bid or purchase order, Sedgwick County may, by written notice, terminate the contract or purchase order.
9. The bidder will certify and warrant that goods, personal property, chattels, and equipment sold and delivered are free and clear of any and all liens, or claims of liens, for materials or services arising under, and by virtue of the provisions of K.S.A. Sections 58-201, et seq., and any other lien, right, or claim of any nature or kind whatsoever.
10. The successful bidder will hold and save Sedgwick County, and its officers, agents, servants/employees harmless from liability of any patented, or unpatented invention, process, article, or appliance manufactured, or used in the performance of the contract, including its use by Sedgwick County. Vendors working on county property or on behalf of County will be required to carry minimum insurance listed in bid document.
11. All items furnished, if applicable, must be the best of their respective kinds, and will be free from defects in material and workmanship. Items will be subject to County inspection and approval at any time within 30 days after delivery. If a substitution is made, it will be the decision of a Sedgwick County representative to determine if it is of equal quality. Items furnished must be manufactured in compliance with all existing legal or governmental directives.
12. Unless specified otherwise, all items bid are to be as a minimum but not necessarily limited to: new, current model year, and untitled prior to shipping and/or installation.
13. Sedgwick County is desirous of allowing as many Kansas vendors as possible the opportunity to participate including minority men and women-owned businesses, and small businesses in the roles of providing goods and services to Sedgwick County. If your company does not fall into any of these categories, your efforts to contract with vendors who do fall into these categories are appreciated. Construction projects utilizing subcontractors requires a subcontracting worksheet. Contact purchasing department for details.
14. Contracts entered into on the basis of submitted bids are revocable if contrary to law.

15. County reserves the right to enter into agreements subject to the provisions of the Cash Basis Law (K.S.A. 10-1112 and 10-1113), the Budget Law (K.S.A. 79-2935). Agreements shall be construed and interpreted so as to ensure that the County shall at all times stay in conformity with such laws, and as a condition of agreements the County reserves the right to unilaterally sever, modify, or terminate agreements at any time if, in the opinion of its legal counsel, the Agreement may be deemed to violate the terms of such law.
16. The Bidder agrees to comply with K.S.A. 44-1030.
 - a. The contractor shall observe the provisions of the Kansas act against discrimination and shall not discriminate against any person in the performance of work under the present contract because of race, religion, color, sex, disability, national origin, or ancestry;
 - b. In all solicitations or advertisements for employees, the contractor shall include the phrase, "equal opportunity employer," or a similar phrase to be approved by the commission;
 - c. If the contractor fails to comply with the manner in which the contractor reports to the commission in accordance with the provisions of K.S.A. 44-1031 and amendments thereto, the contractor shall be deemed to have breached the present contract and it may be canceled, terminated or suspended, in whole or in part, by the contracting agency;
 - d. If the contractor is found guilty of a violation of the Kansas act against discrimination under a decision or order of the commission which has become final, the contractor shall be deemed to have breached the present contract and it may be canceled, terminated or suspended, in whole or in part, by the contracting agency; and
 - e. The contractor shall include the provisions of subsections (a) through (d) in every subcontract or purchase order so that such provisions will be binding upon such subcontractor or vendor.
17. All project participants, consultants, engineers, contractors and subcontractors, must comply with all applicable Federal, State and County laws pertaining to contracts entered into by governmental agencies. All participants must comply with the Americans with Disabilities Act (ADA), including the 2008 ADA Amendments Act, and 2010 ADA Standards for Accessible Design.
18. Contractors/subcontractors performing new construction, maintenance, alterations, or additions to Sedgwick County buildings or facilities must comply with building guidelines/codes, and the 2010 ADA Standards for Accessible Design. Any violation of the provisions of the ADA or 504, or specification deficiencies, should be reported to the county's ADA coordinator. Failure to notify the county's ADA coordinator for remedy may be considered a breach of contract and may be grounds for cancellation, termination for suspension, in whole or in any part of the contract. All construction plans will have the county's ADA coordinator approval prior to beginning any work.
19. Contractors/vendors providing services to the public on behalf of Sedgwick County will agree that all personnel in their employment that have direct contact with the public will attend ADA Awareness and Sensitivity training provided by Sedgwick County or the Independent Living Resource Center. Training should be coordinated through the county's ADA coordinator, (316) 660-7052 and evidence of training shall be provided to the county's ADA coordinator. Any violations of the provisions of ADA or section 504, will be deemed a breach of contract and be subject to termination of contract.
20. The successful bidder may have access to private or confidential data maintained by the County to the extent necessary to carry out its responsibilities of the contract. Contractor shall be responsible for compliance with the privacy provision of the Health Insurance Portability and Accountability Act (HIPAA) and shall comply with all other HIPAA provisions and regulations applicable. If the successful bidder is a business associate as that term is defined under HIPAA, the contract shall include the County's standard business associate addendum. A copy of that standard addendum is available on request.
21. The bidder responding to this bid solicitation proposes to furnish all materials, labor, supplies, equipment and incidentals necessary to provide the equipment/materials/services described herein in accordance with the Notification of Solicitation (if applicable), Request for Information (if applicable), Request for Bid, Addenda, Contract, Bonds, Insurance, Plans, Specifications, any Instructions, Mandatory Requirements and Conditions.
22. Unless specified elsewhere in the document, all prices quoted must be F.O.B. Destination, Freight Prepaid and Allowed, which will include all delivery, handling, and any other charges related to delivery including surcharges.
23. It will be understood that the bidder's sureties and insurers, as applicable, are subject to the approval of the County.
24. Prior to a vendor being awarded a contract, Domestic (Kansas) corporations shall 1) furnish evidence of good standing in the form of a Certificate signed by the Kansas Secretary of State. Foreign (non-Kansas) corporations shall furnish evidence of authority to transact business in Kansas, in the form of a Certificate signed by the Kansas Secretary of State; and 2) a copy of the Corporation Resolution evidencing the authority to sign the Contract Documents, executed by the Corporation's Secretary or Assistant Secretary.

25. Sedgwick County will not award to any vendor that is currently listed in the exclusion records of the SAM (System for Award Management) website maintained by the General Services Administration (GSA) or to any vendor presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency.
26. Sedgwick County reserves the right to conduct background checks at any time on new or existing vendors. Background checks will be used to evaluate eligibility to be engaged in a work capacity by Sedgwick County, and will not be used to discriminate on the basis of race, sex, age, color, religion, national origin, disability, genetic, sexual orientation or veteran status.
27. Upon award, the bidder agrees to execute and deliver to the County a contract in accordance with the contract documents (if applicable) within ten days of notice of the award to the bidder. The bidder agrees that the surety/deposit given concurrently herewith will become the property of the County in the event the bidder fails to execute and deliver such contract within the specified time. In the further event of such failure, the bidder will be liable for the County's actual damages that exceed the amount of the surety.
28. It will be understood that time is of the essence in the bidder's performance. The bidder agrees that the County's damages would be difficult or impossible to predict in the event of a default in the performance hereof; and it is therefore agreed that if the bidder defaults in the performance of the contract documents, the bidder will be liable for payment of the sums stipulated in the contract documents as liquidated damages, and not as a penalty.
29. The bidder hereby certifies that he or she has carefully examined all of the documents for the project, has carefully and thoroughly reviewed this Request for Bid, has inspected the location of the project (if applicable), and understands the nature and scope of the work to be done; and that this bid is based upon the terms, specifications, requirements, and conditions of the Request for Bid documents. The bidder further agrees that the performance time specified is a reasonable time, having carefully considered the nature and scope of the project as aforesaid.
30. It will be understood that any bid and any and/or all referencing information submitted in response to this Request for Bid will become the property of Sedgwick County, and will not be returned. As a governmental entity, Sedgwick County is subject to making records available for disclosure after Board of County Commission approval of the recommendation.
31. Sedgwick County will not be responsible for any expenses incurred by any vendor in the development of a response to this Request for Bid including any onsite (or otherwise) interviews and/or presentations, and/or supplemental information provided, submitted, or given to Sedgwick County and/or its representatives. Further, Sedgwick County will reserve the right to cancel the work described herein prior to issuance and acceptance of any contractual agreement/purchase order by the recommended vendor even if the Board of County Commissioners has formally accepted a recommendation.
32. By submission of a response, the bidder agrees that at the time of submittal, he or she: (1) has no interest (including financial benefit, commission, finder's fee, or any other remuneration) and will not acquire any interest, either direct or indirect, that would conflict in any manner or degree with the performance of bidder's services, or (2) benefit from an award resulting in a "Conflict of Interest". A "Conflict of Interest" will include holding or retaining membership, or employment, on a board, elected office, department, division or bureau, or committee sanctioned by and/or governed by the Sedgwick County Board of County Commissioners. Bidders will identify any interests, and the individuals involved, on separate paper with the response and will understand that the County, at the discretion of the Purchasing Director in consultation with the County Counselor, may reject their bid/quotation. The bidder certifies that this bid is submitted without collusion, fraud or misrepresentation as to other bidders, so that all bids for the project will result from free, open and competitive bidding among all vendors.
33. No gifts or gratuities of any kind shall be offered to any County employee at any time.
34. Sedgwick County will issue a purchase order/contract for the acquisition of products/services specified as a result of an award made in reference to this document. Contract documents will be subject to any regulations governed by the laws of the State of Kansas and any local resolutions specifically applicable to the purchase.
35. Any dispute arising out of the contract documents or their interpretation will be litigated only within the courts of the State of Kansas. No prepayment of any kind will be made prior to shipment. Payment will be made upon verification of delivery, compliance with specifications, assurance that the product/service performs as specified and warranted, and receipt of correct invoicing.
36. Sedgwick County will accept responses transmitted via a facsimile unless stated to the contrary within this document. Bids must be received prior to the time and dates listed to be considered responsive. Sedgwick County will not accept late responses and will return them to the sender. Further, Sedgwick County will NOT: (1) guarantee security of the document received; (2) be held responsible for Bids which are NOT legible (and may choose to reject such responses); and, (3) guarantee that the receiving facsimile machine will accept transmission or that phone lines are functioning and

available for transmission. Submitting a bid response via facsimile does NOT relieve the bidder of: (1) responsibilities stated in the document (such as attendance at a mandatory pre-bid conference); (2) providing non-paper informational items which must be returned with the response (diskettes, large drawings, photographs, models, etc.); and, (3) providing original copies of bid sureties (bonds, certificates of insurance, etc.).

Adult Detention Facility (ADF) Office & Entry Expansion/Remodel

BONDS

PERFORMANCE AND LABOR AND MATERIAL BONDS:

PERFORMANCE AND LABOR AND MATERIAL BONDS shall be furnished to the Owner by the Contractor, in an amount equal to 100 percent of the Contract Sum as security for the faithful performance of the contractor and payment of all persons performing labor and furnishing materials in connection with the contract. Said payment bond shall also be executed as a statutory bond and filed in the office of the Clerk of the District Court of the County in which the Project is located. Contractor shall provide the Owner with a certified copy of said statutory bond as so filed.

BONDS FURNISHED shall be written by a SURETY approved by the U.S. Treasury Dept. and licensed to do business in the State of Kansas. No Work shall be commenced until bonds are in force.

FORM OF BOND shall be Statutory Payment Bond – State of Kansas.

POWER OF ATTORNEY for the surety company agent must accompany each bond issued, and must be certified to include the date of the bonds.

PROVIDE TRIPLICATE COPIES of the bond forms and power of attorney.

COST of the bonds shall be included in the bid and paid for by the Contractor.

END OF SECTION

Adult Detention Facility (DF) Office & Entry Expansion/Remodel

BOND TO THE STATE OF KANSAS STATUTORY PAYMENT BOND (K.S.A. 60-1111, as amended)

WITNESSETH: That _____ ("Principal"),
and _____ ("Surety"), are
hereby jointly and severally held and firmly bound unto the STATE OF KANSAS in the sum of
_____ dollars
(\$_____) lawful money of the United States of America, for the use and
benefit of all persons entitled thereto and for the payment of which we hereby bind ourselves,
our successors, assigns, heirs, executors and administrators.

THE CONDITION OF THE OBLIGATION IS SUCH, THAT,

WHEREAS, the Principal has entered into an Agreement with Sedgwick County, Kansas dated
_____, 2019, for improvements described as the

Adult Detention Facility (ADF) Office & Entry Expansion/Remodel 141 W. Elm St. Wichita, KS 67226

(the "Work") according to the Contract Documents, which are incorporated herein by reference.

NOW, THEREFORE, if the Principal and its subcontractors shall pay all indebtedness incurred
for supplies, materials or labor furnished, used or consumed in connection with the Work
including gasoline, lubricating oils, fuel oils, grease, coal and similar items used or consumed
directly in furtherance of the Work, then this obligation is to be null and void; otherwise to remain
in full force and effect.

The Surety covenants and agrees that no change, extension of time, alteration or addition to the
Contract Documents or to the Work shall in any way reduce, nullify, or affect the Surety's
obligations on this bond; and the Surety hereby waives notice on any such change, extension of
time, alteration or additional to said Contract Documents or Work.

IN WITNESS WHEREOF, the parties hereto have caused this instrument to be executed and
delivered this _____ day of _____, 2019.

Principal _____

Title _____

Surety _____

Title _____

Adult Detention Facility (ADF) Office & Entry Expansion/Remodel

PERFORMANCE BOND

WITNESSETH THAT, _____ (“Principal”) and
_____ (“Surety”) ARE HELD
AND FIRMLY BOUND UNTO THE BOARD OF COUNTY COMMISSIONERS OF SEDGWICK
COUNTY, KANSAS, (the “County”), for the use and benefit of claimants herein below identified
in the amount of:

_____ dollars (\$_____).
and in the amount of any change orders issued for the Work, for which payment Principal and
Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly
and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, THAT,

WHEREAS, Principal has by agreement dated _____, 2019 entered into
a contract with the County for the construction described as **Adult Detention Facility
(ADF) Office & Expansion/Remodel** in accordance with the Contract Documents.

NOW, THEREFORE, if the Principal shall well and truly perform all the covenants, conditions,
and obligations of the Contract Documents and any Addenda and Change Orders and shall hold
the County and all interested property owners harmless against all claims, loss, damage,
demands, or causes of actions which they may sustain or suffer by reason of any breach of said
Contract Documents or of negligence of the Principal or of improper execution of the Work or
use of inferior materials by the Principal; and if said Principal shall maintain the improvements
as provided for in said Contract Documents and shall make good all defects in material and
workmanship for a period of one year, or for such other period as provided for in the Contract
Documents; then, this obligation shall be void: Otherwise to remain in full force and effect.

FURTHERMORE, the Surety consents and agrees that no price change, extension of time,
alteration, or addition to the terms of the Contract Documents or to the Work to be performed
thereunder shall in any way affect Surety’s obligation on this bond; and Surety hereby waives
notice of any such change, extension of time, alteration or addition to said Contract Documents.

IN WITNESS WHEREOF, the Principal and Surety have duly executed these presents all as of
the day and year first above written.

Principal _____

Title _____

Surety _____

Title _____

Adult Detention Facility (ADF) Office & Entry Expansion/Remodel

**CERTIFIED COPY OF A RESOLUTION
OF THE BOARD OF DIRECTORS
OF _____
A KANSAS CORPORATION**

The undersigned, being the duly elected qualified and acting Secretary of _____, a Kansas corporation (the "Corporation"), hereby certifies as follows:

At a special meeting of the board of directors of the Corporation, held _____, 2019, when meeting was duly and properly called according to the by-laws of the Corporation and at which a quorum of said board was present, the following resolution was passed and adopted:

"WHEREAS, the Corporation desires to contract with Sedgwick County, Kansas (the "County") for the construction of certain public improvements, and,

"WHEREAS, the Corporation desires to authorize certain officers of the Corporation to execute and deliver to the County all agreements and documents related thereto.

"NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF DIRECTORS OF _____, a Kansas corporation, that _____ (name), _____ (title), of the Corporation, be and is hereby authorized to execute and deliver to the County all contracts and documents incidental thereto, including but not limited to statutory bonds, construction bonds, insurance agreements and policies, plans and specifications, and any further documents required thereby, relating or pertaining to the following described project:

Adult Detention Facility (ADF) Office & Entry Expansion/Remodel

"BE IT FURTHER RESOLVED BY THE BOARD OF DIRECTORS OF THE CORPORATION that the authority conferred hereby upon such officer is continuing unless notice in writing be given by the Corporation to the County."

DATED this _____ day of _____, 2019.

(SEAL) Secretary

Adult Detention Facility (ADF) Office & Entry Expansion/Remodel

EXHIBIT A

INSURANCE

Liability insurance coverage indicated below must be considered as primary and not as excess insurance. Contractor shall furnish a certificate evidencing such coverage, with County listed as an additional insured, except for professional liability, workers' compensation and employer's liability. Certificate shall be provided with bid/proposal submittals. Certificate shall remain in force during the duration of the project/services and will not be canceled, reduced, modified, limited, or restricted until thirty (30) days after County receives written notice of such change. All insurance must be with an insurance company with a minimum BEST rating of A-VIII and licensed to do business in the State of Kansas. It is the responsibility of Contractor to require that any and all approved subcontractors meet the minimum insurance requirements. Contractor shall obtain the above referenced certificate(s) of insurance, and in accordance with this Agreement, provide copies of such certificates to County.

WORKER'S COMPENSATION

Applicable State: Statutory
Employer's Liability: \$100,000

CONTRACTOR'S LIABILITY INSURANCE. Form of insurance shall be a Comprehensive General Liability Automobile Liability.

1. BODILY INJURY
Each Occurrence: \$500,000
Aggregate: \$500,000
2. PROPERTY DAMAGE
Each Occurrence: \$500,000
Aggregate: \$500,000
3. PERSONAL INJURY
Each Person Aggregate: \$500,000
General Aggregate: \$500,000
4. AUTOMOBILE LIABILITY. Owned, non-owned and hired.
Bodily Injury, Each Person: \$500,000
Bodily Injury, Each Occurrence: \$500,000
Property Damage, Each Occurrence: \$500,000

XCU Coverage

Remove Exclusion.

BUILDER'S RISK INSURANCE

In the amount of the initial Contract Sum, plus the value of subsequent modifications and cost of materials supplied and installed by others, comprising the total value for the entire Project on a replacement cost basis without optional deductibles.

UMBRELLA COVERAGE

Following form for both the general liability and automobile: \$500,000

PROJECT SUBCONTRACTING WORK SHEET
Project Name Adult Detention Facility (ADF) Office & Entry Expansion/Remodel
Check here if you are not using subcontractors _____

Bid #	19-0034
General Contractor	
Created by	

General Contractors shall provide the name, description, DBE classification (type) Minority Certification #, date of work and dollar value for each subcontractor (including lower-tier subcontractors) used to complete the referenced project. Contractors may be required to provide back up documentation to verify information. Each column requires input.

DBE classification type: African American (1); Asian (2); Hispanic (3); Native American (4); other minority (5); Women Owned Business (6). Additional general classifications: Small Business Owner (7); Does not meet any classification (0).

	Subcontractor Name and Address	Type	Jurisdiction Name & Minority Certification # (if vendor has one)	Description of Services	Date of Work	Dollar Value of work
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

Form shall be submitted to Purchasing at the completion of project.

FORM OF CONTRACT

AIA Document A104 with Supplement "Standard Form of Agreement Between Owner and Contractor For construction Projects of Limited Scope".

DRAFT AIA® Document A104™ – 2017

Standard Abbreviated Form of Agreement Between Owner and Contractor

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

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

Sedgwick County Board of County Commissioners
525 N. Main
Wichita, Kansas 67203

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

« »« »
« »
« »
« »

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

«Adult Detention Facility Expansion and Renovation»
«141 W Elm»
«Renovate and expand the lobby and office spaces of the 1st and 2nd floors of the Adult Detention Facility.»

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

« [Schaefer Johnson Cox Fry Architects](#) »« »
« [257 N Broadway Ave.](#) »
« [Wichita, KS 67202](#) »
« [\(316\)684-0171](#) »

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

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

ELECTRONIC COPYING of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of this document.

TABLE OF ARTICLES

1	THE WORK OF THIS CONTRACT
2	DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
3	CONTRACT SUM
4	PAYMENT
5	DISPUTE RESOLUTION
6	ENUMERATION OF CONTRACT DOCUMENTS
7	GENERAL PROVISIONS
8	OWNER
9	CONTRACTOR
10	ARCHITECT
11	SUBCONTRACTORS
12	CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
13	CHANGES IN THE WORK
14	TIME
15	PAYMENTS AND COMPLETION
16	PROTECTION OF PERSONS AND PROPERTY
17	INSURANCE AND BONDS
18	CORRECTION OF WORK
19	MISCELLANEOUS PROVISIONS
20	TERMINATION OF THE CONTRACT
21	CLAIMS AND DISPUTES

EXHIBIT A DETERMINATION OF THE COST OF THE WORK

ARTICLE 1 THE WORK OF THIS CONTRACT

The Contractor shall execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents listed in Article 6 of this Agreement or reasonably inferable by the Contractor from the Contract Documents as necessary to produce the results intended by the Contract Documents to be the responsibility of others.

ARTICLE 2 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 2.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

☐ [« »] The date of this Agreement.

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

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

☐ ☐

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

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

§ 2.3 Substantial Completion

§ 2.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:

(Check the appropriate box and complete the necessary information.)

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

[☐] By the following date: ☐

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

Portion of Work

Substantial Completion Date

§ 2.3.3 All times stated in the Contract Documents, including, without limitation, those for the commencement, prosecution, interim milestones, and completion of the Work, and for the delivery and installation of materials and equipment, are of the essence in this Agreement.

§ 2.3.4 The date of substantial completion of the Work or a designated portion thereof is the date, certified by the Architect, when construction is sufficiently complete in accordance with the Contract Documents that the Owner may, if it so elects, occupy and use the Work or designated portion thereof for the purposes for which it was intended.

§ 2.3.5 If the Contractor fails to achieve Substantial Completion of the Work within the Contract Time and as otherwise required by the Contract Documents, the Owner shall be entitled to retain or recover from the Contractor, as liquidated damages and not as a penalty, the following daily amounts commencing upon the first day following expiration of the Contract Time and continuing until the Date of Substantial Completion. Such liquidated damages are hereby agreed to be a reasonable pre-estimate of damages the Owner will incur as a result of delayed completion of the Work: one hundred thirty-two dollars and fifty cents, (\$132.50).

§ 2.3.6 The Owner may deduct liquidated damages as described in the above paragraph from any unpaid amounts then or thereafter due the Contractor under this Agreement. Any liquidated damages not so deducted from any unpaid amounts due the Contractor shall be payable to the Owner at the demand of the Owner, together with interest from the date of the demand at a rate equal to the lower of the Treasury bill rate or the highest lawful rate of interest payable by the Contractor.

ARTICLE 3 CONTRACT SUM

§ 3.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's proper performance of the Contract and the completion of the Work. The Contract Sum shall be one of the following:
(Check the appropriate box.)

[☒] Stipulated Sum, in accordance with Section 3.2 below

[☐] Cost of the Work plus the Contractor's Fee, in accordance with Section 3.3 below

[« »] Cost of the Work plus the Contractor's Fee with a Guaranteed Maximum Price, in accordance with Section 3.4 below

(Based on the selection above, complete Section 3.2, 3.3 or 3.4 below.)

§ 3.2 The Stipulated Sum shall be « » (\$ « »), subject to additions and deductions as provided in the Contract Documents.

§ 3.2.1 The Stipulated Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:

(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

« »

§ 3.2.2 Unit prices, if any:

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

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

<u>Item</u>	<u>Units and Limitations</u>	<u>Price per Unit (\$0.00)</u>
-------------	------------------------------	--------------------------------

§ 3.2.3 Allowances, if any, included in the stipulated sum:

(Identify each allowance.)

Item	Price
------	-------

§ 3.3 Cost of the Work Plus Contractor's Fee

§ 3.3.1 The Cost of the Work is as defined in Exhibit A, Determination of the Cost of the Work.

§ 3.3.2 The Contractor's Fee:

(State a lump sum, percentage of Cost of the Work or other provision for determining the Contractor's Fee and the method of adjustment to the Fee for changes in the Work.)

« »

§ 3.4 Cost of the Work Plus Contractor's Fee With a Guaranteed Maximum Price

§ 3.4.1 The Cost of the Work is as defined in Exhibit A, Determination of the Cost of the Work.

§ 3.4.2 The Contractor's Fee:

(State a lump sum, percentage of Cost of the Work or other provision for determining the Contractor's Fee and the method of adjustment to the Fee for changes in the Work.)

« »

§ 3.4.3 Guaranteed Maximum Price

§ 3.4.3.1 The sum of the Cost of the Work and the Contractor's Fee is guaranteed by the Contractor not to exceed « » (\$ « »), subject to additions and deductions by changes in the Work as provided in the Contract Documents. This maximum sum is referred to in the Contract Documents as the Guaranteed Maximum Price. Costs which would cause the Guaranteed Maximum Price to be exceeded shall be paid by the Contractor without reimbursement by the Owner.

(Insert specific provisions if the Contractor is to participate in any savings.)

« »

§ 3.4.3.2 The Guaranteed Maximum Price is based on the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:

(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

« »

§ 3.4.3.3 Unit Prices, if any:

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

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

§ 3.4.3.4 Allowances, if any, included in the Guaranteed Maximum Price:

(Identify each allowance.)

Item	Price
------	-------

§ 3.4.3.5 Assumptions, if any, on which the Guaranteed Maximum Price is based:

« »

§ 3.4.3.6 To the extent that the Contract Documents are anticipated to require further development, the Guaranteed Maximum Price includes the costs attributable to such further development consistent with the Contract Documents and reasonably inferable therefrom. Such further development does not include changes in scope, systems, kinds and quality of materials, finishes or equipment, all of which, if required, shall be incorporated by Change Order.

§ 3.4.3.7 The Owner shall authorize preparation of revisions to the Contract Documents that incorporate the agreed-upon assumptions contained in Section 3.4.3.5. The Owner shall promptly furnish such revised Contract Documents to the Contractor. The Contractor shall notify the Owner and Architect of any inconsistencies between the agreed-upon assumptions contained in Section 3.4.3.5 and the revised Contract Documents.

« »

ARTICLE 4 PAYMENT

§ 4.1 Progress Payments

§ 4.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 4.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month and the payment shall be less the specified retainage.

« »

§ 4.1.3 Provided that an Application for Payments is received by the Architect not later than the twenty-fifth (25th) day of a month, the Owner shall make payment to the Contractor not later than the third Friday of the next month. If an Application for Payment is received by the Architect after the date fixed above, payment shall be made by the Owner not later than thirty (30) days after the Architect received the Application for Payment.

(Federal, state or local laws may require payment within a certain period of time.)

§ 4.1.3.1 Notwithstanding anything to the contrary in this Contract, payment of amounts due a Contractor from an Owner, except retainage, shall be made within 30 days after the Owner receives a timely, properly completed, undisputed request for payment according to terms of the contract, unless extenuating circumstances exist which would preclude approval of payment within 30 days. If such extenuating circumstances exist, then payment shall be made within 45 days after the Owner receives such payment request.

§ 4.1.3.2 If the Owner fails to pay Contractor within the time period set in Paragraph 4.1.3.1, the Owner shall pay interest computed at the rate of eighteen percent (18%) per annum on the undisputed amount to the Contractor beginning on the day following the end of the time period set forth in Paragraph 4.1.3.1.

§ 4.1.4 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold retainage from the payment otherwise due as follows:

(Insert a percentage or amount to be withheld as retainage from each Application for Payment and any terms for reduction of retainage during the course of the Work. The amount of retainage may be limited by governing law.)

« »

§ 4.1.5 Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

« » % « »

§ 4.2 Final Payment

§ 4.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

- .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 18.2, and to satisfy other requirements, if any, which extend beyond final payment;
- .2 the Contractor has submitted a final accounting for the Cost of the Work, where payment is on the basis of the Cost of the Work with or without a Guaranteed Maximum Price; and
- .3 a final Certificate for Payment has been issued by the Architect in accordance with Section 15.7.1.

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

« »

ARTICLE 5 DISPUTE RESOLUTION

§ 5.1 Binding Dispute Resolution

For any claim subject to, but not resolved by, mediation pursuant to Section 21.5, the method of binding dispute resolution shall be as follows:

(Check the appropriate box.)

[« »] Arbitration pursuant to Section 21.6 of this Agreement

[« »] Litigation in a court of competent jurisdiction

[« »] Other *(Specify)*

« »

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

ARTICLE 6 ENUMERATION OF CONTRACT DOCUMENTS

§ 6.1 The Contract Documents are defined in Article 7 and, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

§ 6.1.1 The Agreement is this executed AIA Document A104™–2017, Standard Abbreviated Form of Agreement Between Owner and Contractor.

§ 6.1.2 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:

(Insert the date of the E203–2013 incorporated into this Agreement.)

« »

§ 6.1.3 The Supplementary and other Conditions of the Contract are those modified and contained in the Project Manual dated _____.

Document	Title	Date	Pages
----------	-------	------	-------

§ 6.1.4 The Specifications:

(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

« »

Section	Title	Date	Pages
---------	-------	------	-------

§ 6.1.5 The Drawings:

(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

« »

Number	Title	Date
--------	-------	------

§ 6.1.6 The Addenda, if any:

Number	Date	Pages
--------	------	-------

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are enumerated in this Article 6.

§ 6.1.7 Additional documents, if any, forming part of the Contract Documents:

.1 Other Exhibits:

(Check all boxes that apply.)

[☐] Exhibit A, Determination of the Cost of the Work.

[☐] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204–2017 incorporated into this Agreement.)

« »

[☐] The Sustainability Plan:

Title	Date	Pages

[« »] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

- .2 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents.)

« »

ARTICLE 7 GENERAL PROVISIONS

§ 7.1 The Contract Documents

The Contract Documents are enumerated in Article 6 and consist of this Agreement (including, if applicable, Supplementary and other Conditions of the Contract), Drawings, Specifications, Addenda issued prior to the execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results. In the event of inconsistencies within or between parts of the Contracts Documents, or between the Contract Documents and applicable standards, codes, resolutions, and ordinances, the Contract shall (i) provide the better quality or greater quantity of Work or (ii) comply with the more stringent requirement, either or both in accordance with the Architect's interpretation. The terms and conditions of this Paragraph 7.1, however, shall not relieve the Contractor of any obligations set forth in Paragraphs 9.1 and 9.6.

§ 7.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind between any persons or entities other than the Owner and the Contractor.

§ 7.3 The Work

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

§ 7.4 Instruments of Service

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

§ 7.5 Ownership and use of Drawings, Specifications and Other Instruments of Service

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

§ 7.5.2 The Contractor, Subcontractors, Sub-subcontractors and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to the protocols established pursuant to Sections 7.6 and 7.7, solely

and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants.

§ 7.6 Digital Data Use and Transmission

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

§ 7.7 Building Information Models Use and Reliance

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

§ 7.8 Severability

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

§ 7.9 Notice

§ 7.9.1 Except as otherwise provided in Section 7.9.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission in accordance with AIA Document E203™-2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:

(If other than in accordance with AIA Document E203-2013, insert requirements for delivering Notice in electronic format such as name, title and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

« »

§ 7.9.2 Notice of Claims shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 7.10 Relationship of the Parties

Where the Contract is based on the Cost of the Work plus the Contractor's Fee, with or without a Guaranteed Maximum Price, the Contractor accepts the relationship of trust and confidence established by this Agreement and covenants with the Owner to cooperate with the Architect and exercise the Contractor's skill and judgment in furthering the interests of the Owner; to furnish efficient business administration and supervision; to furnish at all times an adequate supply of workers and materials; and to perform the Work in an expeditious and economical manner consistent with the Owner's interests. The Owner agrees to furnish and approve, in a timely manner, information required by the Contractor and to make payments to the Contractor in accordance with the requirements of the Contract Documents.

ARTICLE 8 OWNER

§ 8.1 Information and Services Required of the Owner

§ 8.1.1 Prior to commencement of the Work, at the written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such

evidence. If commencement of the Work is delayed under this Section 8.1.1, the Contract Time shall be extended appropriately.

§ 8.1.2 The Owner shall furnish all necessary surveys and a legal description of the site.

§ 8.1.3 The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 8.1.4 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 9.6.1, the Owner shall secure and pay for other necessary approvals, easements, assessments, and charges required for the construction, use, or occupancy of permanent structures or for permanent changes in existing facilities.

§ 8.2 Owner's Right to Stop the Work

If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents, or repeatedly fails to carry out the Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order is eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.

§ 8.3 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents, and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to any other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 15.4.3, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including the Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 21.

§ 8.4 Extent of Owner's Rights

§ 8.4.1 The rights stated in this Article 8 and elsewhere in the Contract Documents are cumulative and not in limitation of any rights of the Owner (i) granted in the Contract Documents, (ii) in law, or (iii) in equity.

§ 8.4.2 In no event shall Owner have control over, charge of, or any responsibility for construction means, methods, techniques, sequences, or procedures or for the safety precautions and programs in connection with the Work, notwithstanding any of the rights and authority granted the Owner in the Contract Document.

ARTICLE 9 CONTRACTOR

§ 9.1 Review of Contract Documents and Field Conditions by Contractor

§ 9.1.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents. Prior to execution of the Agreement, the Contractor and each Subcontractor shall evaluate and satisfy themselves as to the conditions and limitations under which the Work is to be performed, including, without limitation, (i) the location, condition, layout, and nature of the Project site and surrounding areas, (ii) generally prevailing climactic conditions, (iii) anticipated labor supply and costs, (iv) availability and cost of materials, tools, and equipment, and (v) other similar issues. The Owner assumes no responsibility or liability for the physical condition or safety of the Project site or any improvements located on the Project site. Except as set forth in Paragraph 16.2, the Contractor shall be solely responsible for providing a safe place for the performance of the Work. The Owner shall not be required to make any adjustment in either the contract Sum or Contract Time in connection with any failure by the Contractor or any Subcontractor to have complied with the requirements of this Paragraph 9.1.1.

§ 9.1.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 8.1.2, shall take field measurements of any existing conditions related to that portion of the Work and shall observe any conditions at the site affecting it. These obligations

are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies, or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional unless otherwise specifically provided in the Contract Documents.

§ 9.1.2.1 The exactness of grades, elevations, dimensions, or locations given on any Drawings issued by the Architect, or the work installed by other contractors, is not guaranteed by the Architect or the owner.

§ 9.1.2.2 The Contractor shall, therefore, satisfy itself to the accuracy of all grades, elevations, dimensions, and locations. In all cases of interconnection of its Work with existing or other work, it shall verify at the site all dimensions relating to such existing or other work. Any errors due to the Contractor's failure to so verify all such grades, elevations, dimensions, or locations shall be promptly rectified by the Contractor without any additional cost to the Owner.

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

§ 9.2 Supervision and Construction Procedures

§ 9.2.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters.

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

§ 9.3 Labor and Materials

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

§ 9.3.2 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

§ 9.3.3 The Contractor may make a substitution only with the consent of the Owner, after evaluation by the Architect and in accordance with a Modification.

§ 9.3.4 The Contractor shall deliver, handle, store, and install materials in accordance with manufacturers' instructions.

§ 9.4 Warranty

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements shall be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation or normal wear and tear under normal usage. All other warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 15.6.3. The Contractor agrees to assign to the Owner at the time of final

completion of the Work any and all manufacturer's warranties relating to materials and labor used in the Work and further agrees to perform the Work in such a manner so as to preserve any and all such manufacturer's warranties.

§ 9.5 Taxes

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

§ 9.5.1 Materials

§ 9.5.1.1 Materials and equipment incorporated into this Project are exempt from the payment of sales tax under the laws of the State of Kansas.

§ 9.5.1.2 The owner will provide the contractor with a proper exemption certificate number when the notice to proceed is issued. Should the Owner fail to provide an exemption certification the Contractor shall notify the Architect in writing prior to placing any orders. The contractor shall be reimbursed for sales tax amounts for which he becomes liable until such exemption is provided.

§ 9.5.1.3 Upon issuance of a proper exemption certification number to the Contractor, the Contractor shall assume full responsibility for his own assessed penalties relating to the Contractor's improper use of the exemption certificate. Contractor shall comply with statutes of the State of Kansas related to sales tax exemption.

§ 9.5.1.4 The Contractor shall be responsible for furnishing the Owner a copy of all invoices bearing the exemption certification number pertaining to materials that are incorporated in this project.

§ 9.5.1.5 Contractor shall retain, for a period of not less than five years, all his and his subcontractor's invoices claiming sales tax exemption, properly identified with tax exemption number as required by State of Kansas.

§ 9.5.1.6 Upon completion of the Project, the Contractor shall execute and issue, to the Owner, a certificate of compliance on the form provided by the State Department of Revenue.

§ 9.6 Permits, Fees, Notices, and Compliance with Laws

§ 9.6.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 9.6.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules, regulations and lawful orders of public authorities applicable to performance of the Work. The Contractor shall promptly notify the Architect and Owner if the Drawings and Specifications are observed by the Contractor to be at variance therewith. If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, without such notice to the Architect and Owner, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 9.7 Allowances

The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. The Owner shall select materials and equipment under allowances with reasonable promptness. Allowance amounts shall include the costs to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts. Contractor's costs for unloading and handling at the site, labor, installation, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowance.

§ 9.8 Contractor's Construction Schedules

§ 9.8.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 9.8.2 The Contractor shall perform the Work in general accordance with the most recent schedule submitted to the Owner and Architect.

§ 9.9 Submittals

§ 9.9.1 The Contractor shall review for compliance with the Contract Documents and submit to the Architect Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents in coordination with the Contractor's construction schedule and in such sequence as to allow the Architect reasonable time for review. By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them; (2) determined and verified materials, field measurements, and field construction criteria related thereto, or will do so; and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents. The Work shall be in accordance with approved submittals.

§ 9.9.2 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents.

§ 9.9.3 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents or unless the Contractor needs to provide such services in order to carry out the Contractor's own responsibilities. If professional design services or certifications by a design professional are specifically required, the Owner and the Architect will specify the performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional. If no criteria are specified, the design shall comply with applicable codes and ordinances. Each Party shall be entitled to rely upon the information provided by the other Party. The Architect will review and approve or take other appropriate action on submittals for the limited purpose of checking for conformance with information provided and the design concept expressed in the Contract Documents. The Architect's review of Shop Drawings, Product Data, Samples, and similar submittals shall be for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. In performing such review, the Architect will approve, or take other appropriate action upon, the Contractor's Shop Drawings, Product Data, Samples, and similar submittals.

§ 9.10 Use of Site

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

§ 9.10.1 Only materials and equipment that are to be used directly in the Work shall be brought to and stored on the Project site by the Contractor. After equipment is no longer required for the Work, it shall be promptly removed from the Project site. Protection of construction materials and equipment stored at the Project site from weather, theft, damage, and all other adversity is solely the responsibility of the Contractor. The Contractor shall ensure that the Work, at all times, is performed in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the Work and all adjacent areas. The Work shall be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the site of the Work shall be free from all debris, building materials, and equipment likely to cause hazardous conditions.

§ 9.10.2 The Contractor and any such entity for whom the Contractor is responsible shall not erect any sign on the Project site without the prior written consent of the Owner, which may be withheld in the sole discretion of the Owner.

§ 9.10.3 Without limitation of any other provision of the Contract Documents, Contractor shall use best efforts to minimize any interference with the occupancy or beneficial use of (i) any areas and building adjacent to the site of the Work, and (ii) the Building, in the event of partial occupancy. Without prior approval of the Owner, the Contractor shall not permit any workers to use any existing facilities at the Project site, including, without limitation, lavatories, toilets, entrances, and parking areas other than those designated by the Owner.

§ 9.10.3.1 Without limitation of any other provision of the Contract Documents, the Contractor shall use its best efforts to comply with all resolutions, rules and regulations promulgated by the Owner in connection with the use and occupancy of the Project site and the Building, as amended for time to time. The Contractor shall immediately notify the Owner in writing if during the performance of the Work, the Contractor finds compliance with any portion of such resolutions, rules and regulations to be impracticable, setting forth the problems of such compliance and suggesting alternatives through which the same result intended by such portions of the resolutions, rules and regulations can be

achieved. The Owner may, in the Owner's sole discretion, adopt such suggestions, develop new alternatives, or require compliance with the existing requirements of the resolutions, rules and regulations. In the even Owner requires compliance with subsequently adopted resolutions, rules and regulations, any resulting change in the Work shall be adjusted as provided in Article 13 of the Contract.

§ 9.10.4 The Contractor shall comply with all insurance requirements and collective bargaining agreements applicable to use and occupancy of the Project site and the Building.

§ 9.11 Cutting and Patching

The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly.

§ 9.12 Cleaning Up

The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus material from and about the Project.

§ 9.13 Access to Work

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

§ 9.14 Royalties, Patents and Copyrights

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

§ 9.15 Indemnification

§ 9.15.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) (including loss of use resulting therefrom), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 9.15.1.

§ 9.15.2 In claims against any person or entity indemnified under this Section 9.15 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 9.15.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

§ 9.15.3 The Contractor's indemnity obligations under this Paragraph 9.15 shall also specifically include, without limitation, all fines, penalties, damages, liability, costs, and expenses (including, without limitation, reasonable attorney's fees) arising out of, or in connection with, any (i) violation of or failure to comply with any law, statute, resolution, ordinance, rule, regulation, code, or requirement of a public authority that bears upon the performance of the Work by the Contractor, a Subcontractor, or any person or entity for whom either is responsible, (ii) means, methods, procedures, techniques, or sequences of execution or performance of the Work, and (iii) failure to secure and pay for permits, fees, approvals, licenses, and inspections, as required under the Contract Documents, or any violation of any permit of other approval of a public authority applicable to the Work by the Contractor, a Subcontractor, or any person or entity for whom either is responsible.

§ 9.15.4 The Contractor shall indemnify and hold harmless all of the Indemnitees from and against any costs and expenses (including reasonable attorneys' fees) incurred by any of the Indemnitees in enforcing any of the Contractor's defense, indemnity, and hold harmless obligations under this Contract.

ARTICLE 10 ARCHITECT

§ 10.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction, until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified in writing in accordance with other provisions of the Contract.

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

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

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

§ 10.5 Based on the Architect's evaluations of the Work and of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 10.6 The Architect has authority to reject Work that does not conform to the Contract Documents and to require inspection or testing of the Work.

§ 10.7 The Architect will review and approve or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 10.8 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect will make initial decisions on all claims, disputes, and other matters in question between the Owner and Contractor but will not be liable for results of any interpretations or decisions rendered in good faith.

§ 10.9 The Architect's decisions on matters relating to aesthetic effect, in connection with administration of the Contract, will be final if consistent with the intent expressed in the Contract Documents.

ARTICLE 11 SUBCONTRACTORS

§ 11.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site.

§ 11.2 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the Subcontractors or suppliers proposed for each of the principal portions of the Work. The Contractor shall not contract with any Subcontractor or supplier to whom the Owner or

Architect has made reasonable written objection within ten days after receipt of the Contractor's list of Subcontractors and suppliers. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 11.3 Contracts between the Contractor and Subcontractors shall (1) require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by the terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by the Contract Documents, assumes toward the Owner and Architect, and (2) allow the Subcontractor the benefit of all rights, remedies and redress against the Contractor that the Contractor, by these Contract Documents, has against the Owner.

ARTICLE 12 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 12.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 12.2 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's activities with theirs as required by the Contract Documents.

§ 12.3 The Owner shall be reimbursed by the Contractor for costs incurred by the Owner which are payable to a Separate Contractor because of delays, improperly timed activities, or defective construction of the Contractor. The Owner shall be responsible to the Contractor for costs incurred by the Contractor because of delays, improperly timed activities, damage to the Work, or defective construction of a Separate Contractor.

§ 12.4 The Contractor shall, as part of the Work, provide for the coordination of work to be performed by each separate contractor engaged by the Owner, if any, with the work to be performed by the Contractor or its Subcontractors of any tier. The Contractor shall use its best efforts to cooperate with the Owner and all separate contractors, their subcontractors, and any other entity involved in the performance of the Work. In order to cause the Work and any work to be performed by separate contractors to be completed in an expeditious manner, the Contractor agrees that it will ensure that such separate contractors have a reasonable opportunity to complete their work as and when required.

§ 12.5 If any part of the Work depends on the proper performance of the work of a separate contractor, the Contractor shall, prior to proceeding with the Work, promptly report to the Owner any apparent discrepancies or defects in such other work that render it unsuitable and prevent the Contractor from proceeding expeditiously with the Work.

§ 12.6 If the Contractor wrongfully causes damage to the Work or the property of the Owner, the Contractor shall promptly remedy such damage. If the Contractor wrongfully causes damage to the work or property of any separate contractor, the Contractor shall promptly attempt to settle any resulting dispute or claim with such other contractor.

ARTICLE 13 CHANGES IN THE WORK

§ 13.1 By appropriate Modification, changes in the Work may be accomplished after execution of the Contract. The Owner, without invalidating the Contract, may order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, with the Contract Sum and Contract Time being adjusted accordingly. Such changes in the Work shall be authorized by written Change Order signed by the Owner, Contractor, and Architect, or by written Construction Change Directive signed by the Owner and Architect. Upon issuance of the Change Order or Construction Change Directive, the Contractor shall proceed promptly with such changes in the Work, unless otherwise provided in the Change Order or Construction Change Directive.

§ 13.2 Adjustments in the Contract Sum and Contract Time resulting from a change in the Work shall be determined by mutual agreement of the parties or, in the case of a Construction Change Directive signed only by the Owner and Architect, by the Contractor's cost of labor, material, equipment, and reasonable overhead and profit, unless the

parties agree on another method for determining the cost or credit. Pending final determination of the total cost of a Construction Change Directive, the Contractor may request payment for Work completed pursuant to the Construction Change Directive. The Architect will make an interim determination of the amount of payment due for purposes of certifying the Contractor's monthly Application for Payment. When the Owner and Contractor agree on adjustments to the Contract Sum and Contract Time arising from a Construction Change Directive, the Architect will prepare a Change Order.

§ 13.3 The Architect will have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work.

§ 13.4 If concealed or unknown physical conditions are encountered at the site that differ materially from those indicated in the Contract Documents or from those conditions ordinarily found to exist, the Contract Sum and Contract Time shall be equitably adjusted as mutually agreed between the Owner and Contractor; provided that the Contractor provides notice to the Owner and Architect promptly and before conditions are disturbed. No adjustment in the Contract Time or Contract Sum shall be permitted, however, in connection with a concealed or unknown condition that does not differ materially from those conditions disclosed or that reasonably should have been disclosed by the Contractor's (i) prior inspections, tests, reviews, and preconstruction services for the Project, or (ii) inspections, tests, reviews, and preconstruction services that the Contractor had the opportunity to make or should have performed in connection with the Project.

§ 13.5 Except as permitted in Paragraph 12.1, a change in the Contract Sum or the Contract Time shall be accomplished only by a Change Order. Accordingly, no course of conduct or dealings between the parties, nor express or implied acceptance of alterations or additions to the Work, and no claim that the Owner has been unjustly enriched by any alteration or addition to the Work, whether or not there is, in fact, any unjust enrichment to the Work, shall be the basis of any claim to an increase in any amounts due under the Contract Documents or a change in any time period provided for in the Contract Documents.

§ 13.6 Agreement on any Change Order shall constitute a final settlement of all matters relating to the change in the Work that is the subject of the Change Order, including but not limited to, all direct and indirect costs associated with such change and any and all adjustments to the Contract Sum and the construction schedule.

ARTICLE 14 TIME

§ 14.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing this Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 14.2 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 14.3 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 14.4 The date of Substantial Completion is the date certified by the Architect in accordance with Section 15.6.3.

§ 14.5 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) changes ordered in the Work; (2) by labor disputes, fire, unusual delay in deliveries, abnormal adverse weather conditions not reasonably anticipatable, unavoidable casualties, or any causes beyond the Contractor's control; or (3) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine, subject to the provisions of Article 21.

ARTICLE 15 PAYMENTS AND COMPLETION

§ 15.1 Schedule of Values

§ 15.1.1 Where the Contract is based on a Stipulated Sum or the Cost of the Work with a Guaranteed Maximum Price pursuant to Section 3.2 or 3.4, the Contractor shall submit a schedule of values to the Architect before the first

Application for Payment, allocating the entire Stipulated Sum or Guaranteed Maximum Price to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy required by the Architect. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 15.1.2 The allocation of the Stipulated Sum or Guaranteed Maximum Price under this Section 15.1 shall not constitute a separate stipulated sum or guaranteed maximum price for each individual line item in the schedule of values.

§ 15.2 Control Estimate

§ 15.2.1 Where the Contract Sum is the Cost of the Work, plus the Contractor's Fee without a Guaranteed Maximum Price pursuant to Section 3.3, the Contractor shall prepare and submit to the Owner a Control Estimate within 14 days of executing this Agreement. The Control Estimate shall include the estimated Cost of the Work plus the Contractor's Fee.

§ 15.2.2 The Control Estimate shall include:

- .1 the documents enumerated in Article 6, including all Modifications thereto;
- .2 a list of the assumptions made by the Contractor in the preparation of the Control Estimate to supplement the information provided by the Owner and contained in the Contract Documents;
- .3 a statement of the estimated Cost of the Work organized by trade categories or systems and the Contractor's Fee;
- .4 a project schedule upon which the Control Estimate is based, indicating proposed Subcontractors, activity sequences and durations, milestone dates for receipt and approval of pertinent information, schedule of shop drawings and samples, procurement and delivery of materials or equipment the Owner's occupancy requirements, and the date of Substantial Completion; and
- .5 a list of any contingency amounts included in the Control Estimate for further development of design and construction.

§ 15.2.3 When the Control Estimate is acceptable to the Owner and Architect, the Owner shall acknowledge it in writing. The Owner's acceptance of the Control Estimate does not imply that the Control Estimate constitutes a Guaranteed Maximum Price.

§ 15.2.4 The Contractor shall develop and implement a detailed system of cost control that will provide the Owner and Architect with timely information as to the anticipated total Cost of the Work. The cost control system shall compare the Control Estimate with the actual cost for activities in progress and estimates for uncompleted tasks and proposed changes. This information shall be reported to the Owner, in writing, no later than the Contractor's first Application for Payment and shall be revised and submitted with each Application for Payment.

§ 15.2.5 The Owner shall authorize preparation of revisions to the Contract Documents that incorporate the agreed-upon assumptions contained in the Control Estimate. The Owner shall promptly furnish such revised Contract Documents to the Contractor. The Contractor shall notify the Owner and Architect of any inconsistencies between the Control Estimate and the revised Contract Documents.

§ 15.3 Applications for Payment

§ 15.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 15.1, for completed portions of the Work. The application shall be notarized, if required; be supported by all data substantiating the Contractor's right to payment that the Owner or Architect require; shall reflect retainage if provided for in the Contract Documents; and include any revised cost control information required by Section 15.2.4. Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 15.3.2 With each Application for Payment where the Contract Sum is based upon the Cost of the Work, or the Cost of the Work with a Guaranteed Maximum Price, the Contractor shall submit payrolls, petty cash accounts, receipted invoices or invoices with check vouchers attached, and any other evidence required by the Owner to demonstrate that cash disbursements already made by the Contractor on account of the Cost of the Work equal or exceed progress

payments already received by the Contractor plus payrolls for the period covered by the present Application for Payment, less that portion of the progress payments attributable to the Contractor's Fee.

§ 15.3.3 Payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment stored, and protected from damage, off the site at a location agreed upon in writing.

§ 15.3.4 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or other encumbrances adverse to the Owner's interests.

§ 15.3.5 Partial payments will be made monthly on proper application. Certification will be issued for ninety percent (90%) of the amount requested by the Contractor and approved by the Architect to be properly due until at least fifty percent (50%) of the Contract amount has been paid. Thereafter, the accumulated retainage will remain at five percent (5%) of the Contract amount (including additions, if any) except that should the Contractor at any time fail to keep current with the approved progress schedule, certification of ninety percent (90%) shall automatically again become effective and shall apply so long as the Contract progress lags behind such progress schedule.

§ 15.4 Certificates for Payment

§ 15.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner of the Architect's reasons for withholding certification in whole or in part as provided in Section 15.4.3.

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

§ 15.4.3 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 15.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 15.4.1. If the Contractor and the Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 9.2.2, because of

- .1 defective Work not remedied;
- .2 third-party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or

.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 15.4.4 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 15.4.3, in whole or in part, that party may submit a Claim in accordance with Article 21.

§ 15.5 Progress Payments

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

§ 15.5.2 Neither the Owner nor Architect shall have an obligation to pay or see to the payment of money to a Subcontractor or supplier except as may otherwise be required by law.

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

§ 15.5.4 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 15.6 Substantial Completion

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

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

§ 15.6.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. When the Architect determines that the Work or designated portion thereof is substantially complete, the Architect will issue a Certificate of Substantial Completion which shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

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

§ 15.7 Final Completion and Final Payment

§ 15.7.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions stated in Section 15.7.2 as precedent to the Contractor's being entitled to final payment have been fulfilled. All warranties, guarantees, operational and parts manuals required under or pursuant to the Contract

Documents shall be assembled and delivered by the Contractor to the Architect as part of the final Application for Payment. The final certificate of Payment will not be issued by the Architect until all warranties and guarantees have been received and accepted by the Owner.

§ 15.7.2 Final payment shall not become due until the Contractor has delivered to the Owner a complete release of all liens arising out of this Contract or receipts in full covering all labor, materials and equipment for which a lien could be filed, or a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including costs and reasonable attorneys' fees.

§ 15.7.3 The making of final payment shall constitute a waiver of claims by the Owner except those arising from

- .1 liens, claims, security interests or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

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

ARTICLE 16 PROTECTION OF PERSONS AND PROPERTY

§ 16.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation, or replacement in the course of construction.

The Contractor shall comply with, and give notices required by, applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons and property and their protection from damage, injury, or loss. The Contractor shall promptly remedy damage and loss to property caused in whole or in part by the Contractor, a Subcontractor, a sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 16.1.2 and 16.1.3. The Contractor may make a claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 9.15. When all or a portion of the Work is suspended for any reason, the Contractor shall securely fasten down all coverings and protect the Work, as necessary, from injury by any cause. The Contractor shall promptly report in writing to the Owner and Architect all accidents arising out of or in connection with the Work that cause death, personal injury, or property damage, giving full details and statements of any witnesses. In addition, if death, serious personal injuries, or serious damages are caused, the accident shall be reported immediately by telephone or messenger to the Owner and the Architect.

§ 16.2 Hazardous Materials and Substances

§ 16.2.1 The Contractor is responsible for compliance with the requirements of the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents, and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

ARTICLE 17 INSURANCE AND BONDS

§ 17.1 Contractor's Insurance

§ 17.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in this Section 17.1 or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the insurance required by this Agreement from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 18.4, unless a different duration is stated below:

« »

§ 17.1.2 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than « » (\$ « ») each occurrence, « » (\$ « ») general aggregate, and « » (\$ « ») aggregate for products-completed operations hazard, providing coverage for claims including

- .1 damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;
- .2 personal and advertising injury;
- .3 damages because of physical damage to or destruction of tangible property, including the loss of use of such property;
- .4 bodily injury or property damage arising out of completed operations; and
- .5 the Contractor's indemnity obligations under Section 9.15.

§ 17.1.3 Automobile Liability covering vehicles owned by the Contractor and non-owned vehicles used by the Contractor, with policy limits of not less than « » (\$ « ») per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance, and use of those motor vehicles along with any other statutorily required automobile coverage.

§ 17.1.4 The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as those required under Section 17.1.2 and 17.1.3, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ 17.1.5 Workers' Compensation at statutory limits.

§ 17.1.6 Employers' Liability with policy limits not less than « » (\$ « ») each accident, « » (\$ « ») each employee, and « » (\$ « ») policy limit.

§ 17.1.7 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall procure Professional Liability insurance covering performance of the professional services, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ 17.1.8 If the Work involves the transport, dissemination, use, or release of pollutants, the Contractor shall procure Pollution Liability insurance, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ 17.1.9 Coverage under Sections 17.1.7 and 17.1.8 may be procured through a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ 17.1.10 The Contractor shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Section 17.1 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the period required by Section 17.1.1. The certificates will show the Owner as an additional insured on the Contractor's Commercial General Liability and excess or umbrella liability policy.

§ 17.1.11 The Contractor shall disclose to the Owner any deductible or self-insured retentions applicable to any insurance required to be provided by the Contractor.

§ 17.1.12 To the fullest extent permitted by law, the Contractor shall cause the commercial liability coverage required by this Section 17.1 to include (1) the Owner, the Architect, and the Architect's Consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's Consultants, CG 20 32 07 04.

§ 17.1.13 Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by this Section 17.1, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 17.1.14 Other Insurance Provided by the Contractor

(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

Coverage

Limits

§ 17.2 Owner's Insurance

§ 17.2.2 Property Insurance

§ 17.2.2.1 The Contractor shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, builder's risk insurance with a deductible not to exceed \$1000.00 and sufficient to cover the total value of the entire Project on a replacement cost basis. The Contractor's builder's risk insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed or materials or equipment supplied by others. The builder's risk insurance shall be maintained until Substantial Completion and thereafter as provided in Section 17.2.2.2, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ 17.2.2.2 Unless the parties agree otherwise, upon Substantial Completion, the Contractor shall continue the insurance required by Section 17.2.2.1 or, if necessary, replace the insurance policy required under Section 17.2.2.1 with builder's risk insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 18.4.

§ 17.2.2.3 If the insurance required by this Section 17.2.2 is subject to deductibles or self-insured retentions, the Contractor shall be responsible for all loss not covered because of such deductibles or retentions.

§ 17.2.2.4 If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Contractor shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 18.4, builder's risk insurance with a deductible not to exceed \$1000.00, on a replacement cost basis, protecting the existing structure against direct physical loss or damage, notwithstanding the undertaking of the Work. The Contractor shall be responsible for all co-insurance penalties.

§ 17.2.2.5 Prior to commencement of the Work, the Contractor shall secure the insurance, and provide evidence of the coverage, required under this Section 17.2.2 and, upon the Owner's request, provide a copy of the insurance policy or policies required by this Section 17.2.2. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

§ 17.2.2.6 Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by this Section 17.2.2, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Owner: (1) the Owner, upon receipt of notice from the Contractor, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Contractor or the Owner and (2) the Contract Time and Contract Sum shall be equitably adjusted. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide required insurance.

§ 17.2.2.7 Waiver of Subrogation

§ 17.2.2.7.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by this Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this Section 17.2.2.7 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 17.2.2.8 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements, written where legally required for validity, the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 17.2.3 Other Insurance Provided by the Contractor

(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

Coverage	Limits

§ 17.3 Performance Bond and Payment Bond

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

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

ARTICLE 18 CORRECTION OF WORK

§ 18.1 The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed, or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense, unless compensable under Section A.1.7.3 in Exhibit A, Determination of the Cost of the Work. If prior to the date of Substantial Completion (for the purposes of this Agreement, a project is substantially complete when the Owner can legally take occupancy and use the facility for its intended purpose), the Contractor, a Subcontractor, or anyone for whom either is responsible uses or damages any portion of the Work, including, without limitation, mechanical, electrical, plumbing, and other building systems, machinery, equipment, or other mechanical device, the Contractor shall cause such item to be restored to "like new" condition at no expense to the Owner.

§ 18.2 In addition to the Contractor's obligations under Section 9.4, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established

under Section 15.6.3, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor. The Owner shall, prior to making any written claim, provide the Contractor with an opportunity to make the corrections.

§ 18.3 If the Contractor fails to correct nonconforming Work within a reasonable time, the Owner may correct it in accordance with Section 8.3.

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

§ 18.5 Upon completion of any Work under or pursuant to this Article 18, the one (1) year correction period in connection with the Work requiring correction shall be renewed and recommence. The obligations under Article 18 shall cover any repairs and replacement to any part of the Work or other property caused by the defective Work.

ARTICLE 19 MISCELLANEOUS PROVISIONS

§ 19.1 Assignment of Contract

Neither party to the Contract shall assign the Contract without written consent of the other, except that the Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

§ 19.2 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 21.6.

§ 19.3 Tests and Inspections

Tests, inspections, and approvals of portions of the Work required by the Contract Documents or by applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 19.4 The Owner's representative:

(Name, address, email address and other information)

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§ 19.5 The Contractor's representative:

(Name, address, email address and other information)

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

ARTICLE 20 TERMINATION OF THE CONTRACT

§ 20.1 Termination by the Contractor

If the Architect fails to certify payment as provided in Section 15.4.1 for a period of 30 days through no fault of the Contractor, or if the Owner fails to make payment as provided in Section 4.1.3 for a period of 30 days, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

§ 20.2 Termination by the Owner for Cause

§ 20.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 20.2.2 When any of the reasons described in Section 20.2.1 exists, the Owner, upon certification by the Architect that sufficient cause exists to justify such action, may, without prejudice to any other remedy the Owner may have and after giving the Contractor seven days' notice, terminate the Contract and take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor and may finish the Work by whatever reasonable method the Owner may deem expedient. Upon request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 20.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 20.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 20.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Architect, upon application, and this obligation for payment shall survive termination of the Contract.

§ 20.3 Termination by the Owner for Convenience

The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause. The Owner shall pay the Contractor for Work executed; and costs incurred by reason of such termination, including costs attributable to termination of Subcontracts.

§ 20.3.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

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

§ 20.3.2.1 cease operations as directed by the Owner in the notice;

§ 20.3.2.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work;

§ 20.3.2.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 20.3.3 Upon such termination, the Contractor shall recover as its sole remedy payment for Work properly performed in connection with the terminated portion of the Work prior to the effective date of termination and for items properly and timely fabricated off the Project site, delivered, and stored in accordance with the Owner's instructions. The Contractor hereby waives and forfeits all other claims for payment and damages, including, without limitation, anticipated profits. Owner shall be credited for (i) payments previously made to the Contractor for the terminated portion of the work, (ii) claims that the Owner has against the Contractor under the Contract, and (iii) the value of the materials, supplies, equipment, or other items that are to be disposed of by the Contractor that are part of the Contract Sum.

ARTICLE 21 CLAIMS AND DISPUTES

§ 21.1 Claims, disputes, and other matters in question arising out of or relating to this Contract, including those alleging an error or omission by the Architect but excluding those arising under Section 16.2, shall be referred initially to the Architect for decision if the claimant recognizes the claim prior to the date of final payment. The Contractor and Owner shall not be obligated to resolve any claim, dispute or other matters related to the contract by mediation or arbitration. Any reference in the contract documents to mediation or arbitration is deemed void.

§ 21.2 Notice of Claims

§ 21.2.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 18.2, shall be initiated by notice to the Architect within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 21.2.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 18.2, shall be initiated by notice to the other party.

§ 21.3 Time Limits on Claims

The Owner and Contractor shall commence all claims and causes of action against the other and arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in this Agreement whether in contract, tort, breach of warranty, or otherwise, within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all claims and causes of action not commenced in accordance with this Section 21.3.

§ 21.10 Continuing Contract Performance

Pending final resolution of a Claim, except as otherwise agreed in writing, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

ARTICLE 22 Other Conditions or Provisions

§ 22.1 Contractor shall observe the provisions of the Kansas Acts Against Discrimination and shall not discriminate against any person in the performance of work under the present agreement because of race, religion, color, sex, disability, national origin or ancestry.

§ 22.2 In all solicitation or advertisements for employees, Contractor shall include the phrase "equal opportunity employer" or a similar phrase to be approved by the Kansas Human Rights Commission.

§ 22.3 If Contractor fails to comply with the manner in which Contractor reports to the Kansas Human Rights Commission in accordance with the provisions of K.S.A. 44-1031 and amendments thereto, Contractor shall be deemed to have breached the present contract and it may be canceled, terminated, or suspended in whole or in part, by Sedgwick County (Owner).

§ 22.4 If Contractor is found guilty of a violation of the Kansas Acts Against Discrimination under a decision of order of the Kansas Human Rights Commission which has become final, Contractor shall be deemed to have breached the present agreement and it may be canceled, terminated or suspended, in whole or in part, by Sedgwick County (Owner).

§ 22.5 Contractor shall include the provisions of the above paragraphs 22.1 through 22.4, inclusively, in every subcontract or purchase order so that such provisions will be binding upon such subcontractor or vendor.

This Agreement entered into as of the day and year first written above.

OWNER (Signature)

« »

(Printed name and title)

CONTRACTOR (Signature)

« »« »

(Printed name and title)

Approved as to Form:

Michael Fessinger
Assistant County Counselor

Attest:

Kelly B. Arnold
County Clerk

SECTION 01 10 00 - SUMMARY**PART 1 GENERAL****1.01 PROJECT**

- A. Project Name: SEDGWICK COUNTY ADULT DETENTION FACILITY OFFICE EXPANSION AND ENTRY REMODEL.
- B. Owner's Name: Sedgwick County.
- C. The Project consists of the expansion and remodel of Sheriff's administration space and jail entrance.

1.02 DESCRIPTION OF ALTERATIONS WORK

- A. Scope of demolition and removal work is indicated on drawings and specified in Section 02 41 00.
- B. Renovate the following areas, complete including operational mechanical and electrical work and finishes:
 - 1. Former inmate visitation area.
 - 2. Former video visitation area.
 - 3. Sheriff's Office.
- C. Plumbing: Alter existing system and add new construction, keeping existing in operation.
- D. HVAC: Alter existing system and add new construction, keeping existing in operation.
- E. Electrical Power and Lighting: Alter existing system and add new construction, keeping existing in operation.
- F. Fire Suppression Sprinklers: Alter existing system and add new construction, keeping existing in operation.
- G. Fire Alarm: Alter existing system and add new construction, keeping existing in operation.
- H. Telephone: Alter existing system and add new construction, keeping existing in operation.
- I. Security System: Alter existing system and add new construction, keeping existing in operation.
- J. Owner will remove the following items before start of work:
 - 1. Furniture.
- K. Contractor shall remove and deliver the following to Owner prior to start of work:
- L. Contractor shall remove and store the following prior to start of work, for later reinstallation by Contractor:

1.03 WORK BY OWNER

- A. Items noted NIC (Not in Contract) will be supplied and installed by Owner before Substantial Completion. Some items include:
 - 1. Movable cabinets.
 - 2. Furnishings.
 - 3. Small equipment.
 - 4. Signage and Graphics, interior and exterior.
 - 5. Blinds.
- General Contractor shall cooperate fully with separate contractors so work on those Contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other Contracts. Coordinate the Work of this Contract with

Work performed under separate Contracts to the extent of scheduling and making the necessary spaces available.

- B. Owner will supply and install the following:
 - 1. Video visitation equipment and cabling.

1.04 OWNER OCCUPANCY

- A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
 - 1. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with the day-to-day operations of the Owner. Maintain existing exits unless otherwise indicated
 - 2. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
 - 3. Notify the Owner not less than 72 hours in advance of activities that will affect the operations of the Owner.
- B. Owner intends to occupy the Project upon Substantial Completion.
- C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- D. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings.
 - 1. Do not disturb portions of Project site beyond areas in which the Work is indicated.
- B. Arrange use of site and premises to allow:
 - 1. Owner occupancy.
 - 2. Work by Others.
- C. Provide access to and from site as required by law and by Owner:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Provide temporary exiting pathways as indicated.
 - 3. Do not obstruct roadways, sidewalks, or other public ways without permit.
- D. Existing building spaces may not be used for storage.
- E. Utility Outages and Shutdown:
 - 1. Limit disruption of utility services to hours the building is unoccupied and as coordinated with the Owner.
 - 2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
 - 3. Prevent accidental disruption of utility services to other facilities.
 - 4. Do not disrupt or shut down power to LAN/WAN systems without coordination with the Owner. It is the responsibility of the Contractor to identify these locations with assistance from the Owner prior to starting any Work.
- F. Controlled Substances: Use of tobacco products and other controlled substances within the new or existing building or the Project site is not permitted.

1.06 WORK SEQUENCE

- A. Construct Work in stages during the construction period with each phase substantially complete as indicated:

1. Stage 1: Utility and service relocates at expansion area, temporary entrance and temporary cabling for 2nd floor workstations, removal of glazing and door and infill at former inmate visitation area.
 2. Stage 2: Remainder of Work, keeping the Sheriff's office open on 2nd floor concurrent with remodeling.
- B. Coordinate construction schedule and operations with Owner.

PART 2 PRODUCTS - NOT USED**PART 3 EXECUTION - NOT USED****END OF SECTION**

SECTION 01 21 00 - ALLOWANCES**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Stanley access control, security cameras and paging system allowance.
- B. Payment and modification procedures relating to allowances.

1.02 ALLOWANCE(S)

- A. Include in the Base Bid, amounts for allowances where specified throughout the Project Manual and as listed in the schedule below. Allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes (if applicable), less applicable trade discounts. All other Contractor costs, including but not limited to unloading and handling at the site, installation, wire, labor, sub-contractors, profit, overhead, insurance, bonds, etc. are to be included in the Base Bid.
- B. At closeout of Contract, funds remaining in the Allowance will be credited to the Owner by Change Order. In addition, applicable Contractor costs, including but not limited to unloading and handling at the site, installation, labor, sub-contractors, profit, overhead, insurance, bonds, etc. for any funds remaining in the Allowance shall also be credited to the Owner by change order.

1.03 ALLOWANCES SCHEDULE

- A. Include the stipulated sum of \$[\$144,985.00] for purchase and delivery of Stanley access control, security cameras, paging system devices and programming per attached quote]. See exclusions on attached proposal from Stanley Security to Tania Cole dated 3/7/19.

PART 2 PRODUCTS - NOT USED**PART 3 EXECUTION - NOT USED****END OF SECTION****SEE ATTACHMENT**

To:	Tania Cole
Organization:	Sedgwick Co. ADF, KS
Phone:	316-660-9854
Fax or email:	Tania.cole@sedgwick.gov

**SCOPE OF
WORK****Sedgwick Co. ADF, KS -
Visitation remodel**

3/7/19

Tania:

Below is a brief summary and pricing for the scope of work of the upcoming visitation remodel at the ADF.

- *Provide updated software maps to display renovated area
- *Add programming and headend equipment for 22 swing doors
- *Add programming and headend equipment for 5 slider doors
- *Add PLC input/output for the above mentioned doors
- *Add 4 door control push button stations at desks located on drawings
- *Add 28 new Honeywell proximity readers along with Honeywell enclosures and headend equipment
- *Add 12 new Harding intercom stations along with Harding headend equipment
- *Add 16 new fixed mini-dome cameras to the video system
- *Add 2 fisheye cameras to the video system
- *Add 3 exterior multi-imager cameras to the video system
- *Add 21 Genetec camera licenses to the Genetec VMS
- *Add 1 video archiving server
- *Add 1 video recording server
- *Labor for documentation updates
- *Labor for PLC program modifications
- *Labor for Touch screen design changes
- *Labor for Shop Fabrication
- *Labor for On-site validation and commissioning
- *Labor for freight and warranty

We have not included pricing for door hardware (locks, closers, DPS, etc.), conduit, wire, installation, or terminations required, making this a complete, working system. However, we will provide the necessary information to you.

Price **\$144,985.⁰⁰**

Stanley Convergent Security Solutions, Inc. guarantees its engineering and hardware to be free from defects for a period of 1 year, unless otherwise specified. This warranty does not include acts of God or abuse by the owner.

Terms are due upon receipt. We are not responsible for any work associated with hazardous materials (i.e. asbestos, lead paint, etc) that is associated with the work. This work will be the responsibility of the Owner or General Contractor.

We work under the terms of a purchase order or signed agreement only. No applicable taxes or bonding has been included in our price. Shipping and handling is included. We are pleased to provide this quotation, and we hope it meets with your approval. We will wait to proceed with this change until we receive a Purchase Order/Signed Sales Agreement.

All paperwork to be addressed to: **Stanley Convergent Security Solutions, Inc.** Please email the Purchase order or signed sales agreement to the email address below and send the original to our office to my attention. The price is valid for 30 days. If you have any questions, please feel free to call.

Regards,



Mickey Wydick
Sales Engineer

mickey.wydick@sbdinc.com

317-572-2114 direct

317-201-3454 cell

SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. General administrative requirements.
- B. Copyright.
- C. AIA Documents.
- D. Electronic document submittal service.
- E. Preconstruction meeting.
- F. Progress meetings.
- G. Construction progress schedule.
- H. Contractor's daily reports.
- I. Progress photographs.
- J. Submittals for review, information, and project closeout.
- K. Number of copies of submittals.
- L. Requests for Interpretation (RFI) procedures.
- M. Additional Architectural or Engineering Work.
- N. Submittal procedures.

1.02 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Conform to requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to SJCF:
 - 1. Requests for Interpretation (RFI).
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. Applications for payment and change order requests.
 - 8. Progress schedules.
 - 9. Coordination drawings.
 - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
 - 11. Closeout submittals.

1.03 COPYRIGHT

- A. The Drawings and Project Manual of the Project are copyrighted by SJCF and consultants. Said drawings, details and specifications shall NOT be reproduced in any manner by any contractor, sub-contractor, supplier, or manufacturer for the purpose of preparing required submittals unless specifically directed to do so by these documents.

1.04 AIA DOCUMENTS

- A. Documents of the American Institute of Architects referred to in the specifications can be purchased by the Contractors from:
 - 1. AIA Kansas, Phone (785) 357-5308 or (800) 444-9853.
- B. **Contractors are cautioned that the AIA documents required under this Contract are copyrighted by the AIA.**

PART 2 PRODUCTS - NOT USED**PART 3 EXECUTION****3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE**

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
 - 1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
 - a. Allows for documents to be uploaded.
 - 2. Contractor and SJCF are required to use this service.
 - 3. It is Contractor's responsibility to submit documents in allowable format.
 - 4. Subcontractors, suppliers, and SJCF's consultants are to be permitted to use the service at no extra charge.
 - 5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
 - 6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
 - 7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
 - 8. Automatic CD archive once construction is complete.
- B. Cost: The cost of the service is to be paid by Contractor; include the cost of the service in the Contract Sum.
- C. Submittal Service: Use one of the following:
 - 1. Submittal Exchange (tel: 1-800-714-0024): www.submittalexchange.com/#sle.
 - 2. EADOC LLC (tel: 1-877-305-3844): www.eadocsoftware.com/#sle.
 - 3. Newforma Project Cloud: www.newformaprojectcloud.com/#sle.
- D. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of SJCF and Contractor participating; further training is the responsibility of the user of the service.
- E. Project Closeout: SJCF will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 PRECONSTRUCTION MEETING

- A. SJCF will schedule a meeting after Notice of Award.
- B. Attendance Required:
 - 1. Owner.
 - 2. SJCF.
 - 3. Contractor.
- C. Agenda:

1. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 2. Designation of personnel representing the parties to Contract and SJCF.
 3. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 4. Scheduling.
- D. Record minutes and distribute copies within two days after meeting to participants, with an electronic copy in PDF format to SJCF, Owner, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.
- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required:
1. Contractor.
 2. Owner.
 3. SJCF.
 4. Contractor's superintendent.
 5. Major subcontractors.
- D. Agenda:
1. Review minutes of previous meetings.
 2. Review of work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems that impede, or will impede, planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Review of off-site fabrication and delivery schedules.
 7. Maintenance of progress schedule.
 8. Corrective measures to regain projected schedules.
 9. Planned progress during succeeding work period.
 10. Coordination of projected progress.
 11. Maintenance of quality and work standards.
 12. Effect of proposed changes on progress schedule and coordination.
 13. Other business relating to work.
- E. Record minutes and distribute copies within two days after meeting to participants, with an electronic copy in PDF format to SJCF, Owner, participants, and those affected by decisions made.

3.04 CONSTRUCTION PROGRESS SCHEDULE

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.

- E. Submit updated schedule every 14 days.

3.05 DAILY CONSTRUCTION REPORTS

- A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.
- B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
 - 1. Date.
 - 2. High and low temperatures, and general weather conditions.
 - 3. Safety, environmental, or industrial relations incidents.
 - 4. Meetings and significant decisions.
 - 5. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
 - 6. Testing and/or inspections performed.
 - 7. Signature of Contractor's authorized representative.

3.06 PROGRESS PHOTOGRAPHS

- A. Photography Type: Digital; electronic files.
- B. Provide photographs of site and construction. Take photographs during construction activities where work will be concealed and throughout progress of Work. Photographs may be used to establish location and arrangement of concealed elements such as plumbing systems. These shall be part of the record documents.
- C. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
 - 1. Delivery Medium: Jump drive.
 - 2. File Naming: Include project identification, date and time of view, and view identification.

3.07 REQUESTS FOR INTERPRETATION(RFI)

- A. Definition: A request seeking one of the following:
 - 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in the Contract Documents.
 - 2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of the Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
 - 1. Prepare a separate RFI for each specific item.
 - a. Do not forward requests which solely require internal coordination between subcontractors.
 - 2. Prepare using software provided by the Electronic Document Submittal Service.
 - 3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
 - 1. Include in each request Contractor's signature attesting to good faith effort to determine from the Contract Documents information requiring interpretation.
 - 2. Unacceptable Uses for RFIs: Do not use RFIs to request the following:
 - a. Approval of submittals (use procedures specified elsewhere in this section).
 - b. Approval of substitutions (see Section - 01 60 00 - Product Requirements)
 - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
 - d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
 - 3. Improper RFIs: Requests not prepared in conformance to requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response.
 - 4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, the Contract Documents, with no additional input required to clarify the question. They will be returned without a response.
- E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
- F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 - 1. Indicate current status of every RFI. Update log promptly and on a regular basis.
 - 2. Note dates of when each request is made, and when a response is received.
- H. Review Time: SJCF will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
 - 1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
 - 1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
 - 2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
 - 3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.

3.08 ADDITIONAL ARCHITECTURAL OR ENGINEERING WORK

- A. Design has been based upon product and equipment data available at the time the design work was done.
- B. Any costs for modifying construction and design for substitutes shall be the responsibility of the party making or requesting the substitute for the designed product even when the substitute product is specified. Such costs shall be paid to the Owner who shall reimburse the architect and/or consultants. The rate charged by SJCF Architecture is 100.00 per hour. Consulting Engineers standard rates apply.

3.09 SUBMITTAL SCHEDULE

- A. Items requiring color selections, including mechanical and electrical devices, will not be made until Contractor submits all data and samples for selecting colors and finishes.

3.10 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 - 1. Product data.
 - 2. Shop drawings.
 - 3. Samples for selection.
 - 4. Samples for verification.
- B. Submit to SJCF for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.11 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 - 1. Design data.
 - 2. Certificates.
 - 3. Test reports.
 - 4. Inspection reports.
 - 5. Manufacturer's instructions.
 - 6. Manufacturer's field reports.
 - 7. Other types indicated.
- B. Submit for SJCF's knowledge as contract administrator or for Owner.

3.12 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Final Correction Punch List for Substantial Completion.
- B. When the following are specified in individual sections, submit them at project closeout in conformance to requirements of Section 01 78 00 - Closeout Submittals:
 - 1. Project record documents.
 - 2. Operation and maintenance data.
 - 3. Warranties.
 - 4. Other types as indicated.
- C. Submit for benefit of the Owner during and after project completion.

3.13 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Samples: Submit the number specified in individual specification sections; one of which will be retained by SJCF.
 - 1. Retained samples will not be returned to Contractor unless specifically so stated.

3.14 SUBMITTAL PROCEDURES

- A. General Requirements:
 - 1. Use a separate transmittal for each item.
 - 2. Transmit using approved form.
 - a. Use form generated by Electronic Document Submittal Service software.

3. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 4. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
 5. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - a. For each submittal for review, allow 15 days time to and from the Contractor.
 - b. For sequential reviews involving SJCF's consultants, Owner, or another affected party, allow an additional 7 days.
 6. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
 7. Provide space for Contractor and SJCF review stamps.
 8. When revised for resubmission, identify all changes made since previous submission.
 9. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
 10. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
- B. Product Data Procedures:
1. Submit only information required by individual specification sections.
 2. Collect required information into a single submittal.
 3. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
1. Digital Data Files: Electronic copies of CAD drawings or Building Information Model of the Contract Drawings will be provided by SJCF, Engineers or Consultants for Contractor's use in preparing submittals as follows.
 - a. Cost for each CAD sheet is \$150.00.
 - b. Cost for Navisworks model is \$300.00.
 - c. Contractor to sign Electronic Release Form and pay SJCF prior to receiving CAD sheet(s) or Navisworks model.
 - d. SJCF makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 2. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related work.
 3. Do not reproduce the Contract Documents to create shop drawings.
 4. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

3.15 SUBMITTAL REVIEW

- A. Submittals for Review: SJCF will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: SJCF will acknowledge receipt and review. See below for actions to be taken.
- C. SJCF's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

- D. SJCF's and consultants' actions on items submitted for review:
 - 1. Authorizing purchasing, fabrication, delivery, and installation:
 - a. "No exception taken", or language with same legal meaning.
 - b. "Make corrections noted", or language with same legal meaning.
 - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
 - c. "Submit specified item", or language with same legal meaning.
 - 1) Submit correct item, with review notations acknowledged and incorporated. Submit separately, or as part of project record documents.
 - 2. Not Authorizing fabrication, delivery, and installation:
 - a. "Revise and Resubmit".
 - 1) Resubmit revised item, with review notations acknowledged and incorporated.
 - b. "Rejected".
 - 1) Submit item complying with requirements of Contract Documents.
- E. SJCF's and consultants' actions on items submitted for information:
 - 1. Items for which no action was taken:
 - a. "Received" - to notify the Contractor that the submittal has been received for record only.
 - 2. Items for which action was taken:
 - 3. "Reviewed" - no further action is required from Contractor.
- F. Maintain one complete set of submittals at the Project.

END OF SECTION

SECTION 01 40 00 - QUALITY REQUIREMENTS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Submittals.
- B. Quality assurance.
- C. References and standards.
- D. Testing and inspection agencies and services.
- E. Control of installation.
- F. Mock-ups.
- G. Tolerances.
- H. Defect Assessment.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Test Reports: After each test/inspection, promptly submit two copies of report to SJCF and to Contractor.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Conformance with Contract Documents.
 - k. When requested by SJCF, provide interpretation of results.
 - 2. Test report submittals are for SJCF's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.
- C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to SJCF, in quantities specified for Product Data.
 - 1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to SJCF.
- D. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.03 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
 - 1. Prior to start of Work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.

1.04 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
 - 1. 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 conflicting requirements that are different, but apparently equal, to SJCF for a decision before proceeding. Refer instances of uncertainty as to which two levels of quantity or quality is more stringent to SJCF for decision.
- B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Should specified reference standards conflict with Contract Documents, request clarification from SJCF before proceeding.
 - 1. SJCF may select the more stringent of the two for the application intended.
- D. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of SJCF shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.05 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Contractor shall employ and pay for services of an independent testing agency to perform specified testing.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- C. Contractor Employed Agency:
 - 1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM C1077, and ASTM D3740.
 - 2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
 - 3. Laboratory: Authorized to operate in Kansas.
 - 4. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.

PART 2 PRODUCTS - NOT USED**PART 3 EXECUTION****3.01 CONTROL OF INSTALLATION**

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from SJCF before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Where drawings and/or specifications designate a standard of performance (e.g., fire rating, sound transmission class, insulation value, heating output, air velocity, etc.) the completed installation shall perform at least to the designated standard.

- F. Have Work performed by persons qualified to produce required and specified quality.
- G. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- H. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to conform to the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the SJCF will use to judge the Work.
- C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
- D. Room Mock-ups: Construct room mock-ups as indicated on drawings. Coordinate installation of materials, products, and assemblies as required in specification sections; finish according to requirements. Provide required lighting and any supplemental lighting where required to enable SJCF to evaluate quality of the mock-up.
- E. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- F. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- G. Obtain SJCF's approval of mock-ups before starting work, fabrication, or construction.
- H. Accepted mock-ups shall be a comparison standard for the remaining Work.
- I. Where mock-up has been accepted by SJCF and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by SJCF.

3.03 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from SJCF before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

- A. See individual specification sections and the drawings for testing and inspection required.
- B. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with SJCF and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify SJCF and Contractor of observed irregularities or non-conformance of Work or products.
 - 5. Perform additional tests and inspections required by SJCF.

6. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 2. Agency may not approve or accept any portion of the Work.
 3. Agency may not assume any duties of Contractor.
 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 2. Cooperate with laboratory personnel, and provide access to the Work.
 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 4. Notify SJCF and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
- E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by SJCF.
- F. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

3.05 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not conforming to specified requirements at Contractors expense.
- B. If, in the opinion of SJCF, it is not practical to remove and replace the Work, SJCF will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 41 00 - REGULATORY REQUIREMENTS**PART 1 GENERAL****1.01 SUMMARY of Reference Standards**

- A. Regulatory requirements applicable to this project are the following:
- B. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- C. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- D. 29 CFR 1910 - Occupational Safety and Health Standards; current edition.
- E. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.
- F. ICC (IFC) - International Fire Code; 2012.
- G. ICC (IBC) - International Building Code; 2012.
- H. ICC (IBC) - ICC International Existing Building Code, 2012.
- I. ICC (IPC) - International Plumbing Code; 2015.
- J. IAPMO (UPC) - Uniform Plumbing Code; 2015.
- K. ICC (IMC) - International Mechanical Code; 2015.
- L. NFPA 70 - National Electrical Code; 2014
- M. ICC (IECC) - International Energy Conservation Code; 2006
- N. Kansas Department of Health and Environment.
- O. Applicable State Statutes Annotated (K.S.A.).
- P. ASHRAE 90.1 - 2004.
- Q. National Fire Protection Association, National Fire Codes.
- R. American Welding Society, AWS D1.1-04.
- S. ANSI Safety Code for Elevators and Escalators, ANSI/ASME A17.1, 2004.
- T. Kansas Boiler Safety Act, KSA 44-913, 2006.
- U. All other federal, state, county, and local requirements applicable and/or referenced.

1.02 QUALITY ASSURANCE

- A. Designer Qualifications: Where delegated engineering design is to be performed under the construction contract provide the direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Kansas.

1.03 BUILDING PLAN REVIEW & PERMIT:

- A. The Owner has submitted the Bidding Documents for Code Plan Review and paid the review fee.
- B. The Building Permit(s) and all other construction fees shall be included in the cost of the Work being bid.
 - 1. Development fees charged by the city/county shall be paid for by the Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 42 16 - DEFINITIONS**PART 1 GENERAL****1.01 SUMMARY**

- A. This section supplements the definitions contained in the General Conditions.
- B. Other definitions are included in individual specification sections.
- C. Specifications.
- D. Drawings.

1.02 DEFINITIONS

A great amount of the specification language can be recognized as specific definitions for nominal terms found on the drawings and in other contract documents. Certain terms used more generally throughout the Contract Documents are hereby defined as follows:

- A. Directed, Requested, Etc.: Where not otherwise explained, terms such as "directed," "requested," "authorized," "selected," "approved," "required," "accepted" and "permitted" mean "directed by the Architect," "requested by the Architect," etc. However, no such implied meaning will be interpreted to extend the Architect's responsibility into the Contractor's area of construction supervision.
- B. Furnish: To supply, deliver, unload, inspect for damage and ready for unpacking, assembly and installation.
- C. General Requirements: The terms "General Requirement(s)" and "Division 1 Section(s)" are alike in meaning and significance.
- D. Guarantee and Warranty: Defined to be identical in meaning and used interchangeably.
- E. Indicated: The term "indicated" is a cross reference to details, notes, or schedules on the drawings, other paragraphs or schedules in the specifications, and similar means of recording requirements in the contract documents. Where terms such as "shown," "noted," "scheduled" and "specified" are used in lieu of "indicated," it is for the purpose of helping the reader accomplish the cross reference, and no limitation of location is intended except as specifically noted.
- F. Install, Erect, Construct, and Similar Terms: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use as part of the Work.
- G. Installer: The person or entity engaged by the Contractor or his Subcontractor or Sub-subcontractor for the performance of a particular unit of Work at the project site, including installation, erection, application, and similar required operations. It is a general requirement that Installers be recognized experts in the work they are engaged to perform.
- H. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
- I. Project Site: The space available to the Contractor for the performance of the Work, either exclusively or in conjunction with others performing other work as part of the Project.
- J. Provide: To furnish and install, complete and ready for the intended use.
- K. Reviewed: Where used in conjunction with the Architect's or Engineer's response to submittals, requests, applications, inquiries, reports, and claims by the Contractor, the meaning of the term "reviewed" will be held to the limitations of the Architect's responsibilities and duties as specified in the General and Supplementary Conditions and

General Requirements. In no case will "reviewed" by the Architect be interpreted as an assurance to the Contractor that the requirements of the Contract Documents have been fulfilled.

- L. Supply: Same as Furnish.
- M. Testing Laboratory: An independent entity engaged to perform specific inspections or tests of the work, either at the project site or elsewhere; and to report and (if required) interpret the results of those inspections or tests.

1.03 PROJECT MANUAL

- A. The Project Manual is the volume(s) which binds together the Bidding Documents, General Conditions as Modified, and Specifications; identified for this Contract. The several parts of the volume(s) are listed in the Table of Contents of the volume(s).

1.04 SPECIFICATIONS

- A. General: This series of explanations is provided to assist the user of these specifications and associated contract documents to more readily understand the format, language, implied requirements and similar conventions of the content. None of these explanations will be interpreted to modify the substance of the requirements.
- B. Format Explanation: The format of the principal portions of specifications can be described as follows - although other portions may not fully comply and no particular significance will be attached to such compliance or noncompliance.
- C. Sections: Sections have been subdivided into 3 (or less) "parts" for uniformity and convenience (Part 1 -General, Part 2 - Products, and Part 3 - Execution). These do not imply a particular meaning and are not an integral part of the text which specified requirements.
- D. Imperative language is frequently used and, except as otherwise specified, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading, contrasting subjective language is frequently used to describe the responsibilities which must be fulfilled either indirectly by the Contractor or by others.
- E. Streamlined style of the specifications results in abbreviated and incomplete sentences. Omission of words or phrases such as "the Contractor shall," "according to the plans," "a," "the," and "all" are intentional. Omitted words or phrases shall be supplied by inference in the same manner as they are when a note occurs on the drawings.
- F. Section number is for the purposes of abbreviated identification in connection with cross references. The Sections are placed in the binder(s) in sequence; however, this sequence is not complete and the Table of Contents of the Project Manual must be consulted to determine the total listing of Sections.
- G. Pages of each Section are numbered independently for each Section. The Section number is shown with the page number at the bottom of each page. "End of Section" appears on the last page of each Section. Contractor(s) shall verify that all pages of the Specifications are included.
- H. Detail sheets, when bound in the Project Manual, are numbered and listed on the Detail Table of Contents. Contractor shall verify that all pages of details are included.
- I. Project identification and date of publication, and revision where applicable, of the Contract Documents are recorded on each page to minimize misuse of the specifications and confusion with other project specifications.
- J. Mechanical and Electrical Provisions: Certain portions of Mechanical Work and Electrical Work of the General Requirements have been specified in their Divisions. This is for the traditional convenience and clarity of using the Contract Documents, and no other meaning will be interpreted from this arrangement of content, except as otherwise specifically indicated. They in turn reference certain other Divisions and Sections to

minimize duplication in specifications and to correlate similar work performed by different parties.

- K. Contractors are responsible for their work regardless which Section it is included in.
- L. Contractor's Options: Where more than one set of requirements are specified for a particular unit of work. The option is intended to be the Contractor's.
- M. Specifications and Drawings Complementary: What is included in one is the same as though included in the other or included in both.
- N. Overlapping Requirements and Conflicts: In the event of conflicts between the Contract Documents or between the Contract Documents and applicable standards, codes, resolutions and ordinances, the Contractor shall (1) provide the better quality or greater quantity of Work or (2) comply with the more stringent requirement; or both in accordance with the interpretation of SJCF.
- O. Abbreviations: The language of the Specifications and elsewhere in the Contract Documents is of the abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in the text. Trade associations and general standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular wherever applicable and the full context of the requirement so indicated.

1.05 DRAWINGS

- A. Not all conditions have been detailed although such work is a part of the Contract.
- B. In lieu of details, some work may require conformance with written instructions, notes, and/or standards. Such work is a part of the Contract.
- C. Do not scale drawings for dimensions. Accurately layout such work from dimensions indicated unless such be found in error.
- D. Where drawings indicate a portion of the work and the remainder is shown in outline. The parts drawn out apply to other like portions of the work. Where detail is indicated by starting, only, such detail shall continue to apply throughout the courses or parts in which it occurs and apply to similar parts of work unless otherwise indicated.
- E. Details indicate the general application of work at all locations where it logically applies. Provide other related work incident thereto to fully complete the work consistent with the detail, other related details, and actual conditions.
- F. Consult Architect for interpretations concerning locations of equipment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 45 33 - CODE-REQUIRED SPECIAL INSPECTIONS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Code-required special inspections.
- B. Testing services incidental to special inspections.
- C. Submittals.

1.02 RELATED REQUIREMENTS

- A. Section 01 30 00 - Administrative Requirements: Submittal procedures.
- B. Section 01 40 00 - Quality Requirements.
- C. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.03 DEFINITIONS

- A. Code or Building Code: International Building Code and, more specifically, Chapter 17 - Structural Tests and Inspections, of same.
- B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
- C. Special Inspection:
 - 1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved contract documents and the referenced standards.
 - 2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

1.04 REFERENCE STANDARDS

- A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.
- B. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.
- C. AISC 360 - Specification for Structural Steel Buildings; 2010.
- D. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.
- E. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2012.
- F. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete; 2010.
- G. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.
- H. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing; 2014a.
- I. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2013.
- J. ASTM E605 - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (Reapproved 2011).

- K. ASTM E736 - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2000 (Reapproved 2011).
- L. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestops; 2014.
- M. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2010a.
- N. AWCI 125 - Technical Manual 12-B: Standard Practice for the Testing and Inspection of Field-Applied Thin Film Intumescent Fire-Resistance Materials; 1998.
- O. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- P. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2008.
- Q. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2011.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency shall:
 - 1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
- C. Special Inspection Reports: After each special inspection, Special Inspector shall promptly submit electronic copies of report; to SJCF, to structural engineer, to Contractor and to the AHJ.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of Special Inspector.
 - d. Date and time of special inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of special inspection.
 - h. Date of special inspection.
 - i. Results of special inspection.
 - j. Conformance with Contract Documents.
 - 2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.

1.06 SPECIAL INSPECTION AGENCY

- A. General Contractor will employ and pay for services of a Special Inspection Agency to perform inspections. Refer to specifications for who will employ and pay for material testing and sampling in accordance with ASTM E329 and required by the building code.
- B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.07 QUALITY ASSURANCE

- A. Special Inspection Agency Qualifications:
 - 1. Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS - NOT USED**PART 3 EXECUTION****3.01 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION**

- A. Reference Structural Drawings for requirements.

3.02 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION

- A. Reference Structural Drawings and Project Manual for requirements.

3.03 SPECIAL INSPECTIONS FOR MASONRY CONSTRUCTION

- A. Reference Structural Drawings and Project Manual for requirements.

3.04 SPECIAL INSPECTIONS FOR PRECAST CONCRETE CONSTRUCTION

- A. Reference Structural Drawings for requirements.

3.05 SPECIAL INSPECTIONS FOR SOILS

- A. Reference Structural Drawings and Project Manual for requirements.

3.06 SPECIAL INSPECTIONS FOR POST-INSTALLED ANCHORS AND POST-INSTALLED REINFORCING BARS

- A. Reference Structural Drawings for requirements.

3.07 SPECIAL INSPECTIONS FOR SPRAYED FIRE RESISTANT MATERIALS

- A. Sprayed Fire Resistant Materials, General:
 - 1. Verify compliance of sprayed-fire resistant materials with specific fire-rated assemblies indicated in approved contract documents, and with applicable requirements of the building code.
 - 2. Perform special inspections after rough installation of electrical, mechanical, plumbing, automatic fire sprinkler and suspension systems for ceilings.
- B. Physical and visual tests: Verify compliance with fire resistance rating.
 - 1. Condition of substrates; periodic.
 - 2. Thickness of sprayed fire resistant material; periodic.
 - 3. Density of sprayed fire resistant material in pounds per cubic foot (kg per sq m); periodic.
 - 4. Bond strength (adhesion and cohesion); periodic.
 - 5. Condition of finished application; periodic.
- C. Structural member surface conditions:
 - 1. Inspect structural member surfaces before application of sprayed fire resistant materials; periodic.
 - 2. Verify preparation of structural member surfaces complies with approved contract documents and manufacturer's written instructions; periodic.
- D. Application:
 - 1. Ensure minimum ambient temperature before and after application complies with the manufacturer's written instructions; periodic.
 - 2. Verify area where sprayed fire resistant material is applied is ventilated as required by the manufacturer's written instructions during and after application; periodic.
- E. Thickness: Verify that no more than 10 percent of thickness measurements taken from sprayed fire resistant material are less than thickness required by fire resistance design in approved contract documents. In no case shall the thickness of the sprayed fire resistant material be less than the minimum below.
 - 1. Minimum Allowable Thickness: Tested according to ASTM E605, periodic.

- a. Design thickness 1 inch (25 mm) or greater: Design thickness minus 1/4 inch (6.4 mm).
 - b. Design thickness greater than 1 inch (25 mm): Design thickness minus 25 percent.
2. Floor, Roof and Wall Assemblies: Test thickness according to ASTM E605 with no less than four measurements per 1,000 square feet (93 sq m) of sprayed area on each story of the structure or portion thereof; periodic.
3. Structural Members: Test according to ASTM E605. Test no less than 25 percent of structural members on each story of the structure or portion thereof; periodic.
- F. Density: Verify density of sprayed fire resistant material is no less than density required by the fire resistance design in the approved contract documents.
 1. Floor, Roof and Wall Assemblies: Test according to ASTM E605 with no less than one sample per 2,500 square feet (232 sq m) of sprayed area on each story of the structure or portion thereof; periodic.
 2. Beams, Girders, Trusses and Columns: Test according to ASTM E605 with no less than one sample per 2,500 square feet (232 sq m) of sprayed area on each story of the structure or portion thereof; periodic.
- G. Bond Strength: Verify adhesive and cohesive bond strength of sprayed fire resistant materials is no less than 150 pounds per square foot (7.18 kPa) when in-place samples of the cured material are tested according to ASTM E736 and as described below.
 1. Floor, roof and wall assemblies: Test no less than one sample per each 2,500 square feet (232 sq m) of sprayed area on each story of the structure or portion thereof; periodic.
 2. Structural members: Test no less than one sample from each type of structural member in each 2,500 square feet (232 sq m) of each story of the structure or portion thereof; periodic.

3.08 SPECIAL INSPECTIONS FOR MASTIC AND INTUMESCENT FIRE RESISTANT COATINGS

- A. Verify mastic and intumescent fire resistant coatings comply with AWCI 117 and the fire resistance rating indicated on approved contract documents.

3.09 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

- A. Special Inspection Agency shall:
 1. Provide qualified personnel at site. Cooperate with SJCF and Contractor in performance of services.
 2. Perform specified sampling and testing of products in accordance with specified reference standards.
 3. Ascertain compliance of materials and products with requirements of Contract Documents.
 4. Promptly notify SJCF and Contractor of observed irregularities or non-conformance of work or products.
 5. Perform additional tests and inspections required by SJCF.
 6. Submit reports of all tests or inspections specified.
- B. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by SJCF.
- C. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

3.10 CONTRACTOR DUTIES AND RESPONSIBILITIES

- A. Contractor Responsibilities, General:
 1. Cooperate with agency and laboratory personnel; provide access to the work.
 2. Provide incidental labor and facilities:

- a. To provide access to work to be tested or inspected.
- b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
- c. To facilitate tests or inspections.
- d. To provide storage and curing of test samples.
3. Notify SJCF and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
4. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

END OF SECTION

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Temporary telecommunications services.
- B. Temporary sanitary facilities.
- C. Temporary Controls: Barriers, enclosures, and fencing.
- D. Hoisting Facilities.
- E. Fire Protection.
- F. Security requirements.
- G. Vehicular access and parking.
- H. Waste removal facilities and services.
- I. Project identification sign.
- J. Field offices.
- K. Moisture and Mold Control.

1.02 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

1.03 TEMPORARY UTILITIES - See Section 01 51 00**1.04 TELECOMMUNICATIONS SERVICES**

- A. General Contractor shall provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
 - 1. Windows-based personal computer dedicated to project telecommunications, with necessary software.
 - 2. Telephone Land Lines: One line, minimum; one handset per line.
 - 3. Internet Connections: Minimum of one; DSL modem or faster.
- C. Superintendent for Contractor shall be available by cell phone or other means throughout the day.
- D. Long distance calls shall be paid for by party making call.

1.05 TEMPORARY SANITARY FACILITIES

- A. Contractor to provide and maintain required temporary facilities and enclosures. Provide at time of project mobilization.
 - 1. Temporary toilet facilities shall meet the requirements of the state and local departments of public health.
- B. Use of existing facilities is not permitted.
- C. New permanent facilities may not be used during construction operations.
- D. Maintain daily in clean and sanitary condition.

1.06 BARRIERS

- A. Contractor to provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Provide protection for plants designated to remain. Replace damaged plants.
 - 1. Care, pruning and maintenance of trees which are to remain shall be done under the direction of and in accordance with recommendations of a qualified and approved arborist or tree trimming specialist.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 FENCING

- A. Construction: Contractor's option.
- B. Construction: Commercial grade chain link fence. A panelized system may be utilized.
- C. Provide 6 foot (1.8 m) high fence around construction site; equip with vehicular and pedestrian gates with locks.
 - 1. Extent of Fence: As required to enclose portion determined sufficient to accommodate construction operations.

1.08 EXTERIOR ENCLOSURES

- A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.09 INTERIOR ENCLOSURES

- A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
- B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces unless indicated or required otherwise:
 - 1. Maximum flame spread rating of 75 in accordance with ASTM E84.

1.10 HOISTING FACILITIES

- A. For two stories (including roof) or less above grade; each contractor and subcontractor shall be responsible for providing their own hoisting of their own materials and debris.
- B. Elevator Use: Use of elevator 1 is permitted for workers, only - no material transport. No other elevators may be used.
- C. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
 - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

1.11 FIRE PROTECTION

- A. Contractor shall provide temporary fire protection. Portable fire extinguishers shall be provided with class and extinguishing agent as required by locations and classes of fire exposures. Subcontractors will be responsible for their own specialty requirements. Permanent fire protection equipment used for fire protection during construction shall be the responsibility of the installing contractor.

1.12 SECURITY

- A. Provide security and facilities to protect Work, and Owner's operations from unauthorized entry, vandalism, or theft.
- B. Contractor may provide a "watchman" at their own cost.
- C. Coordinate with Owner's security program.

1.13 VEHICULAR ACCESS AND PARKING

- A. Contractor shall provide adequate access including roads into the site of the structure, if required, for the prosecution of the work. Also provide and maintain at least one temporary or permanent access to each working elevation which is to be permanently occupied
- B. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- C. Coordinate access and haul routes with governing authorities and Owner.
- D. Provide and maintain access to fire hydrants, free of obstructions.
- E. Provide means of removing mud from vehicle wheels before entering streets.
 - 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- F. Existing on-site roads may be used for construction traffic.
- G. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.14 WASTE REMOVAL

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site periodically.
- C. Each Contractor or Subcontractor shall be responsible to collect and deposit their debris in such collection facilities. The Contractor shall be responsible for the removal of all debris from the job site.
- D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.
- F. Trash that blows onto adjacent property shall be removed by the responsible party or parties under the direct supervision of the Contractor.
- G. Subcontractors shall collect and remove their own liquid waste and properly dispose of off-site.

1.15 PROJECT IDENTIFICATION

- A. Provide project identification sign of design and construction indicated on drawings.
- B. Erect on site at location indicated.
- C. No other signs or advertising are allowed without Owner permission except those required by law.
 - 1. Signs customarily located on trailers, field offices and vehicles will be permitted.

1.16 FIELD OFFICES

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.

- B. Provide space for Project meetings, with table and chairs to accommodate 6-12 persons.

1.17 MOISTURE AND MOLD CONTROL

- A. Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
 - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 - 2. Keep interior spaces reasonably clean and protected from water damage.
 - 3. Periodically collect and remove waste containing cellulose or other organic matter.
 - 4. Discard or replace water-damaged material.
 - 5. Do not install material that is wet.
 - 6. Discard, replace or clean stored or installed material that begins to grow mold.
 - 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- C. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
 - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 - 2. Use permanent HVAC system when they come available to control humidity.
 - 3. Comply with manufacturer's written instructions on products for temperature, relative humidity, and exposure to water limits.

1.18 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing facilities used during construction to original condition.
- E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 51 00 - TEMPORARY UTILITIES**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Temporary Utilities: Provision of electricity, lighting, heat, ventilation, and water.

1.02 TEMPORARY ELECTRICITY

- A. Cost: By Owner.
- B. Provide power service required from utility source. Make arrangements with electric utility for service.
1. For sites with no electric service, Contractor shall provide portable generator(s) as required to maintain construction operations until electric service is installed by utility company.
- C. Connect to Owner's existing power service.
1. Do not disrupt Owner's need for continuous service.
 2. Exercise measures to conserve energy.
- D. Provide temporary electric feeder from existing building electrical service at location as directed.
- E. Power Service Characteristics: 277/480 volt, required ampere, three phase, four wire.
1. Each Contractor shall be responsible for power they require exceeding systems specified.
- F. Complement existing power service capacity and characteristics as required.
- G. Electrical Contractor shall provide power outlets for construction operations, with branch wiring and distribution boxes located as required so that an extension no longer than 100 feet (30 m) will reach any work station. Each Contractor shall provide their own flexible power cords as required.
1. Provide sufficient capacity for construction tools, equipment, temporary ventilation and lighting.
 2. Modify, maintain and upon completion of project remove temporary power system.
- H. Electrical Contractor shall provide 30 Amp service to maximum of 4 construction offices.
- I. Employ permanent systems as they are completed and available.
- J. Permanent convenience receptacles may be utilized during construction.

1.03 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain LED, compact fluorescent, or high-intensity discharge lighting as suitable for the application for construction operations in accordance with requirements of 29 CFR 1926 and authorities having jurisdiction.
1. Each Contractor shall be responsible for lighting they require exceeding systems specified.
- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- C. Maintain lighting and provide routine repairs.
1. Upon completion of project or when permanent system are deployed remove temporary lighting system.
- D. Permanent building lighting may be utilized during construction.

1.04 TEMPORARY HEATING

- A. Cost of Energy: By Owner.

- B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.
 - 1. For projects with masonry work scheduled during winter months the Contractor shall pay for and provide temporary heating and tenting as required to meet project schedules.
 - 2. Subcontractors having additional specific or unusual requirements shall be responsible for their own requirements.
- C. Maintain minimum ambient temperature of 50 degrees F (10 degrees C) in areas where construction is in progress, unless indicated otherwise in specifications.
- D. Owner's existing heat plant may be used.
 - 1. Exercise measures to conserve energy.
 - 2. Enclose building prior to activating temporary heat.
- E. Mechanical and Electrical Contractors shall cooperate with General Contractor in making permanent system(s) available as soon as possible.
- F. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.
 - 1. Warranties shall not begin on equipment until the date of substantial completion. Contractor shall purchase extended warranties as required.

1.05 TEMPORARY COOLING

- A. Cost of Energy: By Owner.
- B. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.
 - 1. Subcontractors having additional specific or unusual requirements shall be responsible for their own requirements.
- C. Maintain maximum ambient temperature of 80 degrees F (26 degrees C) in areas where construction is in progress, unless indicated otherwise in specifications.
- D. Owner's existing cooling plant may be used.
 - 1. Exercise measures to conserve energy.
 - 2. Enclose building prior to activating temporary cooling.
- E. Prior to operation of permanent equipment for temporary cooling purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.06 TEMPORARY VENTILATION

- A. Existing ventilation equipment may not be used.

1.07 TEMPORARY WATER SERVICE

- A. Cost of Water Used: By Owner.
- B. Plumbing Contractor shall provide and maintain suitable quality water service for construction operations at time of project mobilization.
 - 1. For sites with no water service, General Contractor shall truck in water as required to maintain construction operations until water service is installed by utility company.
- C. Connect to existing water source.
 - 1. Exercise measures to conserve water.

- D. Extend branch piping with outlets located so water is available by hoses with threaded connections.
 - 1. Provide at least one hose bibb in each floor level.
 - 2. Each contractor shall provide their own water hose.
 - 3. Each Contractor shall be responsible for water they require exceeding systems specified.
- E. Contractor shall provide potable drinking water in convenient and accessible locations, for all persons engaged upon the work, so long as they have personnel on the job.
- F. Employ permanent systems when available and remove temporary service when no longer needed.

PART 2 PRODUCTS - NOT USED**PART 3 EXECUTION - NOT USED****END OF SECTION**

SECTION 01 57 13 - TEMPORARY EROSION AND SEDIMENT CONTROL**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Prevention of erosion due to construction activities.
- B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
- C. Restoration of areas eroded due to insufficient preventive measures.
- D. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 REFERENCE STANDARDS

- A. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus; 2014.
- B. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 1999a (Reapproved 2014).
- C. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; 2011.
- D. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2015a.
- E. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile; 2012.
- F. ASTM D4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2002 (Reapproved 2009).
- G. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; Current Edition.
- H. FHWA FLP-94-005 - Best Management Practices for Erosion and Sediment Control; 1995.
- I. USDA TR-55 - Urban Hydrology for Small Watersheds; USDA Natural Resources Conservation Service; 2009.

1.03 PERFORMANCE REQUIREMENTS

- A. Comply with requirements of 2 for erosion and sedimentation control, as specified by the NPDES, for Phases I and II, and in compliance with requirements of Construction General Permit (CGP).
- B. Comply with all requirements of the city and county for which the project is located for erosion and sedimentation control .
- C. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.
 - 1. Owner will submit a Notice of Intent (NOI) obtain permits and pay yearly fee required to the Department of Health and Environment (KDHE).
 - 2. Owner will withhold payment to Contractor equivalent to all fines resulting from non-compliance with applicable regulations.
- D. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.
- E. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.

1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
 2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.
- F. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
1. Control movement of sediment and soil from temporary stockpiles of soil.
 2. Prevent development of ruts due to equipment and vehicular traffic.
 3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- G. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
1. Prevent windblown soil from leaving the project site.
 2. Prevent tracking of mud onto public roads outside site.
 3. Prevent mud and sediment from flowing onto sidewalks and pavements.
 4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- H. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
 2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.
- I. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
- J. Open Water: Prevent standing water that could become stagnant.
- K. Maintenance: General Contractor shall maintain temporary preventive measures until permanent measures have been established.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Mulch: Use one of the following:
1. Straw or hay.
 2. Wood waste, chips, or bark.
 3. Erosion control matting or netting.
- B. Grass Seed For Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.
- C. Bales: Air dry, rectangular straw bales.
1. Cross Section: 14 by 18 inches (350 by 450 mm), minimum.
 2. Bindings: Wire or string, around long dimension.

- D. Bale Stakes: One of the following, minimum 3 feet (1 m) long:
 - 1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot (1.98 kg per linear m).
 - 2. Wood, 2 by 2 inches (50 by 50 mm) in cross section.
- E. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
 - 1. Average Opening Size: 30 U.S. Std. Sieve (0.600 mm), maximum, when tested in accordance with ASTM D4751.
 - 2. Permittivity: 0.05 sec^{-1} , minimum, when tested in accordance with ASTM D4491.
 - 3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355/D4355M after 500 hours exposure.
 - 4. Tensile Strength: 100 pounds-force (450 N), minimum, in cross-machine direction; 124 pounds-force (550 N), minimum, in machine direction; when tested in accordance with ASTM D4632/D4632M.
 - 5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D4632/D4632M.
 - 6. Tear Strength: 55 pounds-force (245 N), minimum, when tested in accordance with ASTM D4533.
 - 7. Color: Manufacturer's standard.
 - 8. Manufacturers:
 - a. TenCate: www.tencate.com/#sle.
 - b. North American Green: www.nagreen.com/#sle.
 - c. Propex Geosynthetics: www.geotextile.com/#sle.
- F. Silt Fence Posts: One of the following, minimum 5 feet (1500 mm) long:
 - 1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot (1.98 kg per linear m).
 - 2. Softwood, 4 by 4 inches (100 by 100 mm) in cross section.
 - 3. Hardwood, 2 by 2 inches (50 by 50 mm) in cross section.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

- A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES

- A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.
- B. Construction Entrances: Traffic-bearing aggregate surface.
 - 1. Width: As required; 20 feet (7 m), minimum or as indicated on the drawings.
 - 2. Length: 50 feet (16 m), minimum or as indicated on the drawings.
 - 3. Provide at each construction entrance from public right-of-way.
 - 4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.
- C. Linear Sediment Barriers: Made of silt fences or straw bales.
 - 1. Provide linear sediment barriers:
 - a. Where indicated on the drawings.

- D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:
 - 1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.
 - 2. Straw bale row blocking entire inlet face area; anchor into pavement.
- E. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.
- F. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout outlets and storm water outlets.
- G. Soil Stockpiles: Protect using one of the following measures:
 - 1. Cover with polyethylene film, secured by placing soil on outer edges.
 - 2. Cover with mulch at least 4 inches (100 mm) thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches (150 mm) of straw or hay.
- H. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.
 - 1. Wood Waste: Use only on slopes 3:1 or flatter; no anchoring required.
- I. Temporary Seeding: Use where temporary vegetated cover is required.

3.04 INSTALLATION

- A. Traffic-Bearing Aggregate Surface:
 - 1. Excavate minimum of 6 inches (150 mm).
 - 2. Place geotextile fabric full width and length, with minimum 12 inch (300 mm) overlap at joints.
 - 3. Place and compact at least 6 inches (150 mm) of 1 1/2 to 3 1/2 inch (40 to 90 mm) diameter stone.
- B. Silt Fences:
 - 1. Store and handle fabric in accordance with ASTM D4873.
 - 2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch (405 mm) high barriers with minimum 36 inch (905 mm) long posts spaced at 6 feet (1830 mm) maximum, with fabric embedded at least 4 inches (100 mm) in ground.
 - 3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch (710 mm) high barriers, minimum 48 inch (1220 mm) long posts spaced at 6 feet (1830 mm) maximum, with fabric embedded at least 6 inches (150 mm) in ground.
 - 4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet (6 m), use nominal 32 inch (810 mm) high barriers with woven wire reinforcement and steel posts spaced at 4 feet (1220 mm) maximum, with fabric embedded at least 6 inches (150 mm) in ground.
 - 5. Install with top of fabric at nominal height and embedment as specified.
 - 6. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches (460 mm), with extra post.
 - 7. Fasten fabric to wood posts using one of the following:
 - a. Four nails per post with 3/4 inch (19 mm) diameter flat or button head, 1 inch (25 mm) long, and 14 gage, 0.083 inch (2.11 mm) shank diameter.
 - b. Five staples per post with at least 17 gage, 0.0453 inch (1.150 mm) wire, 3/4 inch (19 mm) crown width and 1/2 inch (12 mm) long legs.
 - 8. Fasten fabric to steel posts using wire, nylon cord, or integral pockets.
 - 9. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches (300 mm) high with post spacing not more than 4 feet (1220 mm).

C. Straw Bale Rows:

1. Install bales in continuous rows with ends butting tightly, with one bale at each end of row turned uphill.
2. Install bales so that bindings are not in contact with the ground.
3. Embed bales at least 4 inches (100 mm) in the ground.
4. Anchor bales with at least two stakes per bale, driven at least 18 inches (450 mm) into the ground; drive first stake in each bale toward the previously placed bale to force bales together.
5. Fill gaps between ends of bales with loose straw wedged tightly.
6. Place soil excavated for trench against bales on the upslope side of the row, compacted.

D. Mulching Over Large Areas:

1. Dry Straw and Hay: Apply 2-1/2 tons per acre (6350 kg per hectare); anchor using dull disc harrow or emulsified asphalt applied using same spraying machine at 100 gallons of water per ton of mulch.
2. Wood Waste: Apply 6 to 9 tons per acre (15,200 to 20,800 kg per hectare).
3. Erosion Control Matting: Comply with manufacturer's instructions.

E. Mulching Over Small and Medium Areas:

1. Dry Straw and Hay: Apply 4 to 6 inches (100 to 150 mm) depth.
2. Wood Waste: Apply 2 to 3 inches (50 to 75 mm) depth.
3. Erosion Control Matting: Comply with manufacturer's instructions.

F. Temporary Seeding:

1. When hydraulic seeder is used, seedbed preparation is not required.
2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft (0.5 kg per 100 sq m).
4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft (6 to 8 kg per 100 sq m).
5. Incorporate fertilizer into soil before seeding.
6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch (12 to 25 mm) deep.
7. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.
8. Repeat irrigation as required until grass is established.

3.05 MAINTENANCE

- A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches (13 mm) or more rainfall at the project site, and daily during prolonged rainfall.

- B. Repair deficiencies immediately.

C. Silt Fences:

1. Promptly replace fabric that deteriorates unless need for fence has passed.
2. Remove silt deposits that exceed one-third of the height of the fence.
3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

D. Straw Bale Rows:

1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.

2. Remove silt deposits that exceed one-half of the height of the bales.
 3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- E. Clean out temporary sediment control structures weekly and relocate soil on site.
- F. Place sediment in appropriate locations on site; do not remove from site.

3.06 CLEAN UP

- A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by SJCF.
- B. Clean out temporary sediment control structures that are to remain as permanent measures.
- C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION

SECTION 01 60 00 - PRODUCT REQUIREMENTS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.

PART 2 PRODUCTS**2.01 EXISTING PRODUCTS**

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.
- B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.
- C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.
 - 1. The Owner has first salvage rights on materials and equipment whether identified to remain as property of the Owner or not.

2.02 NEW PRODUCTS

- A. Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
- B. DO NOT USE products having any of the following characteristics:
 - 1. Containing lead, cadmium, asbestos.

2.03 PRODUCT OPTIONS

- A. General: The specifying of particular products, materials and systems is done to establish a minimum standard of performance, quality, type and physical characteristics.
- B. Prebid approval is required for proposed materials, equipment or systems for manufacturers not specified or listed in the Contract Documents when other manufacturers and/or products are specified and there is listed a Provision for Substitutions.
- C. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- D. Products where it is specified by name, model number or series to establish quality with a Provision for Substitutions: Use product indicated. Submit a request for substitution for any product not named.
- E. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- F. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.
- G. Where Contractor proposes products or systems as a "Bidders Alternate", a request for substitution is not required. Follow requirements under section 01 23 00 - Alternates.

2.04 PRODUCT OPTIONS AFTER BID

- A. After execution of contract, substitutions of materials, equipment or systems other than those specified and approved by addendum will be approved by the SJCF only if the following are met:
 - 1. Materials specified and ordered in a timely manner cannot be delivered to the job in time to complete the work in proper sequence.
 - 2. An equal or superior material is proposed.
 - 3. The Project cost will lower or remain unchanged.

2.05 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver and place in location as directed; obtain receipt prior to final payment.

PART 3 EXECUTION**3.01 TRANSPORTATION AND HANDLING**

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.02 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Comply with manufacturer's warranty conditions, if any.
- H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

- I. Prevent contact with material that may cause corrosion, discoloration, or staining.
- J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Surveying for laying out the work.
- F. Cleaning and protection.
- G. Starting of systems and equipment.
- H. Demonstration and instruction of Owner personnel.
- I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- J. General requirements for maintenance service.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Efficiency, maintenance, or safety of any operational element.
 - 3. Visual qualities of sight exposed elements.
 - 4. Work of Owner or separate Contractor.
 - 5. Include in request:
 - a. Location and description of affected work.
 - b. Necessity for cutting or alteration.
 - c. Description of proposed work and products to be used.
 - d. Date and time work will be executed.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.03 QUALIFICATIONS

- A. For demolition work, employ a firm specializing in the type of work required.
- B. For surveying work, employ a land surveyor registered in Kansas and acceptable to SJCF. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

1.04 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

- E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
 - 1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
 - 2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.
- F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
 - 1. Minimize amount of bare soil exposed at one time.
 - 2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
 - 3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
 - 4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- G. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
- H. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.
- I. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.05 COORDINATION

- A. See Section 01 10 00 for occupancy-related requirements.
- B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- C. Notify affected utility companies and comply with their requirements.
- D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- G. Coordinate completion and clean-up of work of separate sections.
- H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS**2.01 PATCHING MATERIALS**

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify SJCF four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to SJCF, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify SJCF of any discrepancies discovered.

- C. Contractor shall locate and protect survey control and reference points.
- D. Control datum for survey is that indicated on drawings.
- E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- F. Promptly report to SJCF the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to SJCF.
- H. Utilize recognized engineering survey practices.
- I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations.
- J. Periodically verify layouts by same means.
- K. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 ORDERING, RECEIVING, AND STORING MATERIALS

- A. Order materials in timely manner to assure delivery in ample time for orderly incorporation into the Work.
- B. On receipt of materials, check for in-transit damage in ample time to replace any damaged materials prior to installation time.
- C. Wherever possible deliver materials and equipment to project site in manufacturer's original packages, keeping labels intact until final cleaning. Where items are to be job-assembled, label, tag, mark or otherwise properly identify each component part until incorporated in the Work.
- D. Store materials in a manner to prevent deterioration, staining, soiling and intrusion of foreign materials. Provide waterproof well-ventilated enclosures for materials subject to deterioration by dampness. Adequately protect those materials subject to damage by freezing and frost.
- E. Remove from premises and replace with new, any materials showing deterioration or damage.

3.06 MANUFACTURER'S REQUIREMENT:

- A. All materials and equipment supplied for this building shall be installed, applied or erected in strict accordance with the manufacturer's recommendations or with manufacturer's trade association requirements unless the specifications bound herewith exceed those requirements.
 - 1. Exception: Methods or procedures, set forth in the manufacturer's recommendations which the Contractor finds unacceptable shall be submitted to SJCF in writing for clarification.

3.07 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.
- F. Prepare all work to receive subsequent work or finish as needed and described in specifications for both substrate and subsequent products.
- G. Furnish, apply, install, connect, erect, clean and condition manufactured articles, materials, and equipment per manufacturer's printed directions. If otherwise indicated or specified, notify SJCF well in advance of installation and prerequisite construction.
- H. Manufacturer's printed directions must be on job prior to and during installation of materials and equipment.
- I. Provide all attachment devices and materials necessary to secure materials together or to other materials and to secure work of other trades.
- J. Make allowance for ample expansion and contraction for all building components subject to same.
- K. Each trade shall build in openings required for their own work and sleeves furnished by another trade for their work and prepare openings when another trade requires and furnishes the information in a timely manner. Each trade shall be responsible for cutting into construction when they have not acted in timely manner; all in accordance with CUTTING AND PATCHING in this section. Each trade shall be responsible for filling around their work, within blockouts, sleeves, and holes for their work, to maintain the integrity (acoustic, fire, smoke, appearance, etc.) of the construction.
- L. Where proper fit of work depends upon close tolerances of manufactured products, furnish manufacturer with necessary templates to insure proper fit of all components.
- M. Install materials only when conditions of adjacent building components are conducive to achieving best installation results.
- N. Construct job assemblies accurately and as necessary for other trades having adjunct work. Correct errors in cutting, shop fabrication and installation. Where necessary to cut into other building components, do so only in a manner not to damage building structurally nor aesthetically, then repair adjoining parts and materials thoroughly and neatly.
- O. Erect, install and secure building components in a structurally sound and appropriate manner. Where necessary, temporarily brace, shore, or otherwise support members until final connection or installation. Brace walls and other structural elements to prevent damage by wind and construction operations. Leave temporary bracing, shoring, or other structural supports in place as long as necessary for safety and until structure is strong enough to withstand all loads involved.
- P. Where construction consists of a series of courses or units, assemble units in best acceptable manner to provide structurally sound installation, waterproof where exposed to exterior. Accurately plumb and level all courses and verify levels of frequent courses with instrument.
- Q. Handle materials in manner to prevent scratching, abrading, distortion, chipping, breaking or other disfigurement to those materials as well as to materials and construction already existing.
- R. Unless indicated, fabricate and install materials true to line, plumb and level. Leave finished surfaces smooth and flat or of smooth contour where indicated, free from wrinkles, warps, scratches, dents, and other imperfections

- S. Provide quality of workmanship not less than the commercially accepted standards of that trade.
- T. Where obviously of best practice, furnish materials in longest practical lengths and largest practical sizes to avoid unnecessary jointing. Make all joints secure.
- U. Consult SJCF for mounting height or position of any unit not specifically located.
- V. Mix no more materials than can be used before materials begin to "set". Mix no partially "set" batch with another. Clean tools and appliances prior to mixing materials that can be contaminated.
- W. Conduct work in a manner to avoid injury to previously placed work.
- X. Do not disturb materials requiring curing time until appropriate curing time has transpired.
- Y. Install, connect, service, and operate permanent systems at earliest practical dates, except as may be modified by specification section 01 51 00.

3.08 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to SJCF before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
 - 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
 - 2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
- D. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings.
 - 2. Relocate items indicated on drawings.
 - 3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 - 4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, Telecommunications, and LAN/WAN/Data Systems): Remove, relocate, and extend existing systems to accommodate new construction.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 - 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
 - 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.

- a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - b. Provide temporary connections as required to maintain existing systems in service.
4. Verify that abandoned services serve only abandoned facilities.
5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings as indicated; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- F. Protect existing work to remain.
 1. Prevent movement of structure; provide shoring and bracing if necessary.
 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.
- G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
 1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to SJCF.
 2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
 3. Where a change of plane of 1/4 inch (6 mm) or more occurs in existing work, submit recommendation for providing a smooth transition for SJCF review and request instructions.
 4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.
- H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- I. Refinish existing surfaces as indicated:
 1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- J. Clean existing systems and equipment.
- K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- L. Do not begin new construction in alterations areas before demolition is complete.
- M. Comply with all other applicable requirements of this section.

3.09 CUTTING AND PATCHING

- A. **Prior approval for cutting and patching is required unless waived by the SJCF.**
- B. **Approval of SJCF to proceed with proposed cutting-and-patching does not waive right to later require complete removal and replacement of work found to be cut-and-patched in an unsatisfactory manner.**
- C. General:
 1. "Cutting-and-patching" is hereby defined to include, but is not necessarily limited to; the cutting and patching of nominally completed and existing work, in order to accommodate the coordination of work, or the installation of other work, or to

- uncover other work for access or inspection, or to obtain samples for testing, or for repair or correction, or for similar purposes.
2. Patching also is defined as repair to new or existing landscaping or other features.
 3. Existing work shall be prepared, cleaned, and patched as required for new work by appropriate trades, ready for the subsequent finishes.
 4. Excavating and the associated operations of boulder removal, dewatering, bracing, removal of underground debris, penetration of rock and other barriers, backfilling, and similar work as specified in Division 31 and in other contract documents, may be required as a special form of cutting-and-patching, but is recognized primarily as an example of a related-but-separate category of work.
 5. Restoring or removing and replacing non-complying work may require cutting-and-patching operations as specified herein.
 6. Refer to other sections of these specifications and all drawings for ramifications regarding work necessary to accomplish installation of items shown.
 7. Each trade shall be responsible for the sizing, location, timing, coordinating and cost for cutting and patching necessary to accommodate their work. Cutting and patching shall be done by individuals skilled in working the tools and materials involved.
- D. Quality Assurance:
1. Requirements for Structural Work: Do not cut-and-patch structural work in a manner resulting in a reduction of load-carrying capacity or load/deflection ratio.
 2. Operational and Safety Limitations: Do not cut-and-patch operational elements and safety-related components in a manner resulting in a reduction of capacities to perform in the manner intended or resulting in decreased operational life, increased maintenance, or decreased safety. Operational elements include but are not limited to the following:
 - a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Mechanical systems piping and ducts.
 - f. Control systems.
 - g. Fire alarm and Communication systems.
 - h. Conveying systems.
 - i. Electrical wiring systems.
 - j. Operating systems of special construction.
 3. Other Construction Elements: Do not cut and patch other construction elements or 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. Other construction elements include but are not limited to the following:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Exterior curtain-wall construction.
 - d. Equipment supports.
 - e. Piping, ductwork, vessels, and equipment.
 - f. Noise- and vibration-control elements and systems.
 4. Visual Requirements: Do not cut-and-patch work which is exposed on the exterior or exposed in occupied spaces of the building, in a manner resulting in a reduction of visual qualities or resulting in substantial evidence of the cut-and-patch work, both as judged solely by the Architect. Remove and replace work judged by the Architect to be cut-and-patched in a visually unsatisfactory manner. Trade requiring

- cutting may use small escutcheons or similar trim at piping, ducts and the like, if permitted for new work, and not as a device to cover work which should be patched.
5. Engage the original Installer/Fabricator to perform cutting-and-patching in new construction. Engage capable personnel to perform cut-and-patch work.
- E. Submittals:
1. Unless waived by SJCF, submit proposal well in advance of time work will be performed and request approval to proceed. Include description of why cutting-and-patching cannot (reasonably) be avoided, how it will be performed, products to be used, firms and tradesmen to perform the work, approximate dates of the work, and anticipated results in terms of variations from the work as originally completed.
 2. SJCF may require that the Contractor provide structural engineering services through the project structural engineer at the Contractor's expense.
 3. Where applicable, include cost proposal, suggested alternatives to the cutting-and-patching procedure proposed
- F. Materials: Provide materials for cutting-and-patching which will result in equal-or-better work than the work being cut-and-patched, in terms of performance characteristics and including visual effect where applicable. Comply with the requirements, and use materials identical with the original materials where feasible and where recognized that satisfactory results can be produced thereby.
- G. Whenever possible, execute the work by methods that avoid cutting or patching.
- H. See Alterations article above for additional requirements.
- I. Perform whatever cutting and patching is necessary to:
1. Complete the work.
 2. Fit products together to integrate with other work.
 3. Provide openings for penetration of mechanical, electrical, and other services.
 4. Match work that has been cut to adjacent work.
 5. Repair areas adjacent to cuts to required condition.
 6. Repair new work damaged by subsequent work.
 7. Remove samples of installed work for testing when requested.
 8. Remove and replace defective and non-conforming work.
- J. Protection: Construct barriers to separate work areas from occupied areas and to protect building occupants from danger of uncontrolled temperature and pollution. Seal openings as needed to provide such protection.
1. Ventilate areas where dust and odors are produced to the outside.
 2. Provide and maintain filters over building ventilating and return air outlets enveloped by dust enclosures when system ties into occupied areas.
- K. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- L. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
1. Minimize the use of hammering and chopping tools.
- M. Restore work with new products in accordance with requirements of Contract Documents.
- N. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- O. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.

P. Patching:

1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. 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 in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance unless otherwise indicated.
3. Ceilings: Patch, repair, or rehang in-place ceilings as necessary or as indicated to provide an even-plane surface of uniform appearance.
4. Match color, texture, and appearance.
5. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.
6. Restore exposed finishes of patched areas, and where necessary, extend finish restoration and new finish onto adjoining retained work, in a manner which will eliminate evidence of patching. As an example; where patch occurs in or adjacent to a painted surface, extend final paint coat over the entire unbroken surface containing the patch after patched area has received prime and base coats and whole surface prepared for painting.

3.10 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
 1. Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.11 PROTECTION OF INSTALLED WORK

- A. Protect existing construction, property and installed work from damage by construction operations, weather and its elements.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Prohibit traffic from landscaped areas.
- H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.
- I. Remove ice and snow as necessary for safety and proper execution of Work.

- J. Brace all construction to prevent damage from wind and construction loading.
- K. Transport, handle, store and erect materials in a manner to keep them free from injury.
- L. Repair damaged materials, systems, equipment and the like. If satisfactory repair cannot be attained, replace damaged products with equally aesthetic and serviceable products, systems and equipment.
- M. Clean off any foreign materials accidentally deposited on finish surfaces and, where such would stain, corrode or otherwise disfigure, clean same immediately with material that will not damage finished work.

3.12 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify SJCF and Owner seven days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.13 DEMONSTRATION AND INSTRUCTION

- A. See Section 01 79 00 - Demonstration and Training.

3.14 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Adjust windows, doors, drawers, hardware, appliances, motors, valves, controls, and other equipment for proper operation.
- C. Seal exterior joints between materials to form a weathertight enclosure.
- D. Touch up imperfections in surfaces, paint, and other finishes after all Contractors and tradesmen have completed their work.
- E. Completed work shall be thoroughly clean and free from foreign materials and stains.
- F. Clean surfaces using appropriate materials and methods that will thoroughly clean but not damage materials and their finishes, not damage or adversely affect other materials in the project.

3.15 FINAL CLEANING

- A. Execute final cleaning prior to Substantial Completion.
 - 1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.
 - 2. 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 manufacturer's written instructions.
- B. Use cleaning materials that are nonhazardous.

- C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- F. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances
- G. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
- H. Replace filters of operating equipment.
- I. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
- J. Clean site; sweep paved areas, rake clean landscaped surfaces.
- K. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.16 CLOSEOUT PROCEDURES

- A. 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 (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. Advise Owner of pending utility changeover requirements if applicable.
 - 4. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 5. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - 6. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 - 8. Complete final cleaning requirements, including touchup painting.
 - 9. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to SJCF.
- C. Notify SJCF when work is considered ready for SJCF's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete (by General Contractor and Subcontractors) in accordance with Contract Documents and ready for SJCF's Substantial Completion inspection.
 - 1. Separate inspections for mechanical, electrical and general construction work and equipment shall be arranged in the same basic time period by SJCF, engineers and consultants.
 - 2. SJCF may decline to perform the inspection if the building (or designated portion) can not be used for the intended purpose.

3. SJCF may also terminate the inspection at any time if the amount and/or type of incomplete work demonstrates that the building can not be used for the intended purpose without generating an inspection report.
- E. Conduct Substantial Completion inspection and create Final Correction Punch List containing SJCF's and Contractor's comprehensive list of items identified to be completed or corrected and submit to SJCF.
- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Notify SJCF when work is considered finally complete and ready for SJCF's Substantial Completion final inspection.
- H. Complete items of work determined by SJCF listed in executed Certificate of Substantial Completion.
- I. All additional inspections incurred by SJCF and/or consultants because of incomplete or unsatisfactory work will be charged to the Contractor. Time will be billed through the Owner at \$100.00 per worker hour for time chargeable to the Project whether on site, traveling, or in office. Payments to be deducted from amounts owed to the Contractor by the Owner without any additional action required by the Owner, SJCF, or Contractor.

3.17 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.

END OF SECTION

SECTION 01 78 00 - CLOSEOUT SUBMITTALS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties.

1.02 SUBMITTALS

- A. Project Record Documents: Submit documents to SJCF with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance. Submit two copies.
- C. Warranties:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.
- D. Consent of Surety to Final Payment, on AIA Form G707. Submit three copies.
- E. Contractor's Affidavit of Payment of Debts and Claims, AIA Document G706. Submit three copies.
- F. Contractor's Affidavit of Release of Liens, AIA Document G706A. Submit three copies.
- G. Contractor's Release or Waiver of Liens, conditional upon receipt of payment, on the Contractor's letterhead. Submit three copies.
 - 1. The Owner reserves the right to require any other data necessary to establish satisfactory payment of all contractual obligations.
- H. Sales Tax Exemption Certificate. Submit two copies.
- I. If required by Owner or SJCF, one copy each of all invoices properly identified with the Sales Tax Exemption number as required by the State of Kansas. The Contractor shall retain such invoices for a period of not less than five years.
- J. For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the work.

PART 2 PRODUCTS - NOT USED**PART 3 EXECUTION****3.01 PROJECT RECORD DOCUMENTS**

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Drawings.
 2. Specifications.
 3. Addenda.
 4. Change Orders and other modifications to the Contract.
 5. Reviewed shop drawings, product data, and samples.
 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
1. Manufacturer's name and product model and number.
 2. Product substitutions or alternates utilized.
 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 2. Field changes of dimension and detail.
 3. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- B. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- C. Additional information as specified in individual product specification sections.
- D. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
1. Description of unit or system, and component parts.
 2. Identify function, normal operating characteristics, and limiting conditions.
 3. Include performance curves, with engineering data and tests.

4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- E. Provide servicing and lubrication schedule, and list of lubricants required.
- F. Include manufacturer's printed operation and maintenance instructions.
- G. Include sequence of operation by controls manufacturer.
- H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- I. Include test and balancing reports.
- J. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabs dividing each system.
- C. Submit operations and maintenance manuals in in the form of hard copy, bound and labeled volumes, and in the form of pdf electronic file.
- D. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- E. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- F. Project Directory: Title and address of Project; names, addresses, and telephone numbers of SJCF, Consultants, Contractor and subcontractors, with names of responsible parties.
- G. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- H. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- I. Arrangement of Contents: Organize each volume in parts as follows:
 1. Project Directory.
 2. Table of Contents, of all volumes, and of this volume.
 3. Operation and Maintenance Data: Arranged by system, then by product category.
 - a. Source data.
 - b. Product data, shop drawings, and other submittals.
 - c. Operation and maintenance data.
 - d. Field quality control data.
 - e. Photocopies of warranties and bonds.

4. Design Data: To allow for addition of design data furnished by SJCF or others, provide a tab labeled "Design Data".

3.06 WARRANTIES

- A. For all pieces of operating equipment and system provided by any trade for this Project and when warranties or guarantees are otherwise specified, submit written guarantee or warranty documents which shall include the following information:
 1. Name and address of Project and Owner.
 2. Article, material or system covered.
 3. Name and address of Installing contractor.
 4. Name and address of Prime Contractor.
 5. Signature of individual authorized to sign contracts for the company issuing the guarantee.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 1. Scan warranties and assemble complete warranty submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide table of contents at beginning of document.
- D. The following terms (minimum) shall be incorporated:
 1. Duration, one year or as specified, dated from "Date of Substantial Completion." This shall be in addition to and not a limitation of other rights the Owner may have under the Contract Documents.
 2. The article, material or system is free from defective materials and workmanship.
 3. Costs of repair or replacement shall not accrue to the Owner including repair or replacement of other work disturbed by repair or replacement.
- E. Guarantees which are standard guarantees provided by a manufacturer for his product shall be received by the Contractor, filled out and filed with the company for the Owner. Certificates or registration stubs shall be included with the shop drawings submitted for the Owner upon completion of the work. The Contractor's responsibility stipulated in the paragraph before this one, terminates as stipulated therein. The Owner shall administrate manufacturer's warranties/guarantees thereafter.
- F. Co-execute submittals when required.
- G. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

SECTION 01 79 00 - DEMONSTRATION AND TRAINING**PART 1 GENERAL****1.01 SUMMARY**

- A. Demonstration of products and systems where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
 - 1. All software-operated systems.
 - 2. HVAC systems and equipment.
 - 3. Plumbing equipment.
 - 4. Electrical systems and equipment.
 - 5. Landscape irrigation.
 - 6. Items specified in individual product Sections.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Training Reports:
 - 1. Identification of each training session, date, time, and duration.
 - 2. Sign-in sheet showing names and job titles of attendees.

1.03 QUALITY ASSURANCE

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
 - 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
 - 2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED**PART 3 EXECUTION****3.01 DEMONSTRATION - GENERAL**

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstration may be combined with Owner personnel training if applicable.
- C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
 - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
 - 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
 - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

- A. Conduct training on-site unless otherwise indicated.
- B. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by

Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

1. Installing subcontractor/supplier, SJCF, Engineer/Consultant shall be invited.
- C. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
1. The location of the O&M manuals and procedures for use and preservation; backup copies.
 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
 3. Typical uses of the O&M manuals.
- D. Product- and System-Specific Training:
1. Review the applicable O&M manuals.
 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
 3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
 4. Provide hands-on training on all operational modes possible and preventive maintenance.
 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
 6. Discuss common troubleshooting problems and solutions.
 7. Discuss any peculiarities of equipment installation or operation.
 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
 10. Review spare parts and tools required to be furnished by Contractor.
 11. Review spare parts suppliers and sources and procurement procedures.
- E. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

SECTION 02 41 00 - DEMOLITION**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Building demolition excluding removal of hazardous materials and toxic substances.
- B. Selective demolition of built site elements.
- C. Selective demolition of building elements for alteration purposes.
- D. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 10 00 - Summary: Sequencing and staging requirements.
- C. Section 01 10 00 - Summary: Description of items to be removed by Owner.
- D. Section 01 10 00 - Summary: Description of items to be salvaged or removed for re-use by Contractor.
- E. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- F. Section 01 57 13 - Temporary Erosion and Sediment Control.
- G. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- H. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- I. Section 02 84 00 - Polychlorinate Biphenyl (PCB) Remediation: Removal of equipment containing substances regulated under the Federal Toxic Substances Control Act (TSCA), including but not limited to PCB- and mercury-containing equipment.
- J. Section 31 20 00 - Earth Moving: Fill material for filling holes, pits, and excavations generated as a result of removal operations

1.03 REFERENCE STANDARDS

- A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Site Plan: Showing:
 - 1. Areas for temporary construction and field offices.
 - 2. Areas for temporary and permanent placement of removed materials.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: Company specializing in the type of work required.
 - 1. Minimum of three years of documented experience.

PART 2 PRODUCTS -- NOT USED**PART 3 EXECUTION****3.01 SCOPE**

- A. Remove portions of existing buildings in the following sequence:
 - 1. Site Improvements and Entry Canopy.
 - 2. Precast Wall Panels.
- B. Remove all paving and curbs as indicated on drawings.
- C. Remove footing and foundation walls in their entirety as indicated on drawings.
- D. Remove concrete slabs on grade as indicated on drawings.
- E. Remove manholes and manhole covers, curb inlets and catch basins where indicated on drawings.
- F. Remove other items indicated, for salvage and relocation.
- G. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 20 00.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with other requirements specified in Section 01 70 00.
- B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Use of explosives is not permitted.
 - 3. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - a. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - b. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - c. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.
 - 4. Provide, erect, and maintain temporary barriers and security devices.
 - 5. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - 6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 7. Do not close or obstruct roadways or sidewalks without permit.
 - 8. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 - 9. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- C. Do not begin removal until receipt of notification to proceed from Owner.
- D. Do not begin removal until built elements to be salvaged or relocated have been removed.

- E. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.
- F. Protect existing structures and other elements that are not to be removed.
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.
- G. Promptly repair damages caused to adjacent facilities by demolition work.
- H. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- I. If hazardous materials are discovered during removal operations, stop work and notify SJCF and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
- J. Perform demolition in a manner that maximizes salvage and recycling of materials.
 - 1. Dismantle existing construction and separate materials.
 - 2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.
- K. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.
- L. Refrigerant: Remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction before starting demolition.

3.03 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Unused underground piping may be abandoned in place, provided it is completely drained and capped; remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
- H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to SJCF before disturbing existing installation.
 - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Demolition work for remodeling and replacement of work within existing remaining building shall be done by subcontractors and trades who shall be responsible for

removing equipment and materials from the building. Except for Owner's salvage, items removed shall become the property of Contractor. Refer Section 01 10 00, who shall also be responsible for disposing of it as waste or salvage. Owner has first salvage rights.

- C. Demolition work is not specified in detail. Much of the work will be implied by indications on the drawings. For example, removing of a wall may involve removal and patching of the surface preparatory for new finish; piping being removed to at least behind the wall surface; removal of systems extending into areas not being demolished but systems will become inoperative. Complete removal of such systems may not be required except to avoid conflict with other work and finished appearance; removal of doors will involve removing of anchorage, furring, grounds, etc.
- D. Work is shown and called out to be "removed." When the word "removed" is used without any modifiers, it shall mean that it and any associate items built with or into it shall be disconnected, removed, services terminated, or treated as otherwise noted.
- E. Where "removed" is modified those instructions shall be followed. Remaining construction shall be patched and finished equivalent to other similar and remaining work.
- F. Asbestos reports for the buildings are available for review at the District's Administration office. This information is for the use of the Contractors to avoid disturbance of any areas identified by the reports.
 - 1. General Contractor shall remove asbestos containing floor tile and asbestos containing mastic per KDHE requirements and shall obtain and pay for the cost of a Clearance by an independent testing company before tenting measures are removed. The Contractor shall remove any non-containing asbestos mastic and prep the floor surface as required to accept the new scheduled floor finish.
 - 2. Owner shall remove asbestos containing pipe insulation.
- G. Separate areas in which demolition is being conducted from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 .
- H. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
 - 1. Provide adequate dams and protection to prevent rain water from entering into the existing building.
- I. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings.
 - 2. Stock pile removed items such as existing ceiling tile, glazed tile block and trim which is removed as part of the demolition work to be used as patch materials to match surrounding surfaces where areas are indicated to be patched or filled.
- J. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - 3. See Section 01 10 00 for other limitations on outages and required notifications.
 - 4. Verify that abandoned services serve only abandoned facilities before removal.

5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings or in tunnels where indicated; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- K. Protect existing work to remain.
 1. Prevent movement of structure; provide shoring and bracing if necessary.
 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - a. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces.
 - b. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 3. Repair adjacent construction and finishes damaged during removal work.
 4. Patch as specified for patching new work.
- L. Moveable Equipment: The Owner shall cooperate with the Contractor and will move their property and the residents as specified in 01 10 00 Sequencing and staging requirements. The Contractor shall schedule and coordinate the work with the Owner to allow time to accomplish the work. There may be times and situations when minimal amount of work is required that the Contractor will find it expeditious to move furniture out of workers way. Perform such work.

3.05 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
 1. Legally dispose of materials in a landfill. Do not burn demolished materials.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 03 10 00 - CONCRETE FORMING AND ACCESSORIES**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Formwork for cast-in place concrete, with bracing and anchorage.
- B. Openings for other work.
- C. Form accessories.
- D. Form stripping.

1.02 RELATED REQUIREMENTS

- A. Section 03 20 00 - Concrete Reinforcing.
- B. Section 03 30 00 - Cast-in-Place Concrete.
- C. Section 05 12 00 - Structural Steel Framing: Placement of embedded steel anchors and plates in cast-in-place concrete.

1.03 REFERENCE STANDARDS

- A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.
- B. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).
- C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.
- D. ACI 347R - Guide to Formwork for Concrete; 2014.
- E. ASME A17.1 - Safety Code for Elevators and Escalators; 2013.
- F. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.
- G. PS 1 - Structural Plywood; 2009.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate pertinent dimensions, materials, bracing, special form joints and reveals, and arrangement, location and pattern of joints and ties. Review is for general architectural applications and features only. Designing formwork for structural stability and efficiency is Contractor's responsibility.
- C. Product Data: Material and type of form liners.
- D. Samples: Submit 2 inch (51 mm) long samples of waterstops.

1.05 MOCK-UP

- A. Construct a mock-up of formwork for exterior ramp / stair walls , 4 feet (1.2192 m) long by 2 feet (0.61 m) high.
 - 1. Include reinforcement, ties, and accessories specified in Section 03 20 00.
 - 2. Provide concrete in accordance with provisions of Section 03 30 00.
 - 3. Cure concrete in accordance with provisions of Section 03 30 00.
 - 4. Provide sample of custom colored concrete.
- B. Locate mock-up where directed.
- C. Demolish mockup and remove from site.

PART 2 PRODUCTS**2.01 FORMWORK - GENERAL**

- A. Provide concrete forms, accessories, and bracing as required to accomplish cast-in-place concrete work .
- B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.
- C. Comply with applicable State and local codes with respect to design, fabrication, erection, and removal of formwork.
- D. Comply with relevant portions of ACI 347R, ACI 301, and ACI 318.

2.02 WOOD FORM MATERIALS

- A. Softwood Plywood: PS 1, B-B High Density Concrete Form Overlay, Class I.
- B. Plywood: PS 1, B-B Concrete Form Panels, Class 1, Exterior Grade, mill-applied release agent and edge sealed.

2.03 REMOVABLE PREFABRICATED FORMS

- A. Preformed Steel Forms: Minimum 16 gage, 0.0598 inch (1.52 mm) thick, matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- B. Preformed Plastic Forms: Thermoplastic polystyrene form liner, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- C. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

2.04 FORMWORK ACCESSORIES

- A. Form Ties: Removable or snap-off type, galvanized metal, fixed length, cone type, with waterproofing washer, 1 1/2 inch back break dimension, (38 mm back break dimension,) free of defects that could leave holes larger than 1 inch (25 mm) in concrete surface.
- B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.
 - 1. Composition: Colorless reactive, mineral oil-based, soy-based, or vegetable-oil based compound.
 - 2. Do not use materials containing diesel oil or petroleum-based compounds.
 - 3. Products:
 - a. SpecChem, LLC; Bio Strip WB (water-based): www.specchemllc.com/#sle.
 - b. W. R. Meadows, Inc; Duogard: www.wrmeadows.com/sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Filler Strips for Chamfered Corners: Rigid plastic type; 3/4 x 3/4 inch (19 x 19 mm) size; maximum possible lengths.
- D. Flashing Reglets: Galvanized steel, at least 22 gage, 0.0299 inch (0.76 mm) thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.
- E. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

- F. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 12 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS

- A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.03 ERECTION - FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- D. Arrange form-facing material in an orderly and symmetrical manner with a minimum of seams.
- E. Align joints and make watertight. Keep form joints to a minimum.
- F. Obtain approval before framing openings in structural members that are not indicated on drawings.
- G. Provide chamfer strips on external corners of site walls.
- H. Coordinate this section with other sections of work that require attachment of components to formwork.
- I. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from SJCF before proceeding.

3.04 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations. Use low-VOC compound.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Coat steel forms with a nonstaining, rust preventative material. Rust-stained steel formwork is not acceptable.
- D. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items that will be cast directly into concrete.
- C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- D. Position recessed anchor slots for brick veneer masonry anchors to spacing and intervals specified in Section 04 20 01.
- E. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

- F. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement.
- G. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- H. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.06 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
 - 1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
 - 2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.07 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.

3.08 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. Inspect erected formwork and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.
- C. Do not reuse wood formwork more than two times for concrete surfaces to be exposed to view. Do not patch formwork.
- D. Split, frayed, delaminated or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

3.09 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Formwork not supporting weight of concrete, such as sides of beams, walls, columns and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations and providing curing and protection operations are maintained.
- C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.
- D. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- E. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION

SECTION 03 20 00 - CONCRETE REINFORCING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Reinforcing steel for cast-in-place concrete.
- B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

- A. Section 03 10 00 - Concrete Forming and Accessories.
- B. Section 03 30 00 - Cast-in-Place Concrete.
- C. Section 03 45 00 - Precast Architectural Concrete: Reinforcement for precast concrete panels.
- D. Section 04 20 00 - Unit Masonry: Reinforcement for masonry.

1.03 REFERENCE STANDARDS

- A. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).
- B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.
- C. ACI SP-66 - ACI Detailing Manual; 2004.
- D. ASTM A1094/A1094M - Standard Specification for Continuous Hot-Dip Galvanized Steel Bars for Concrete Reinforcement; 2016.
- E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
- F. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement; 2014.
- G. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.
- H. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2011.
- I. CRSI (DA4) - Manual of Standard Practice; 2009.
- J. CRSI (P1) - Placing Reinforcing Bars; 2011.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices. Include special reinforcing required for openings through concrete structures.
 - 1. Prepare shop drawings under the supervision of a Professional Structural Engineer experienced in design of work of this type and licensed in Kansas.
- C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301.

PART 2 PRODUCTS**2.01 REINFORCEMENT**

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
 - 1. Deformed billet-steel bars.

2. Unfinished.
- B. Reinforcing Steel: ASTM A706/A706M, deformed low-alloy steel bars.
 1. Unfinished.
 2. Provide where specifically defined on the drawings.
- C. Reinforcement Accessories:
 1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch (1.29 mm).
 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcing bars, dowels and welded wire reinforcement during concrete placement.
 3. For slabs-on-grade and footings, use supports with sand plates or horizontal runners where base material will not support chair legs.
 4. For exposed-to-view concrete surfaces and directly plastered surfaces, where legs of supports are in contact with forms: Provide stainless steel or plastic components for placement within 1-1/2 inches (38 mm) of weathering surfaces.
 5. Slabs-on-grade Joint Dowel Bars: ASTM A615/A615M Grade 60 (420) smooth steel bars, cut true to length with ends square and free of burrs.

2.02 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.
- B. Welding of reinforcement is not permitted, except where specifically defined on the drawings. Weld reinforcing bars according to ASW D1.4/D1.4M where specifically required.
- C. Locate reinforcing splices not indicated on drawings at point of minimum stress.
 1. Review locations of splices with SJCF.
 2. Clearly define all splice locations on the shop drawing submittal.

PART 3 EXECUTION

3.01 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position. Do not tack weld crossing reinforcing bars.
- B. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports and as specified.
- C. Do not displace or damage vapor barrier.
- D. Clean reinforcement of loose rust and mill scale, earth, ice and other materials that reduce or destroy bond with concrete.
- E. Accommodate placement of formed openings.
- F. Conform to applicable code for concrete cover over reinforcement.
- G. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- H. Bond and ground all reinforcement to requirements of Electrical Specifications.

3.02 FIELD QUALITY CONTROL

- A. An independent testing agency, as specified in Section 01 40 00, will inspect installed reinforcement for conformance to contract documents before concrete placement.

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Elevated concrete slabs on metal deck.
- B. Floors and slabs on grade.
- C. Concrete foundation walls and footings.
- D. Miscellaneous concrete elements, including equipment pads, light pole bases, flagpole bases, thrust blocks, and manholes.
- E. Concrete curing.

1.02 RELATED REQUIREMENTS

- A. Section 03 10 00 - Concrete Forming and Accessories: Forms and accessories for formwork.
- B. Section 03 20 00 - Concrete Reinforcing.
- C. Section 07 92 00 - Joint Sealants: Products and installation for sealants for saw cut joints and isolation joints in slabs.
- D. Section - Mechanical Specification: Mechanical items for casting into concrete.
- E. Section - Electrical Specification: Electrical items for casting into concrete.

1.03 REFERENCE STANDARDS

- A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.
- B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).
- C. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete; 1998 (Reapproved 2004).
- D. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).
- E. ACI 302.1R - Guide for Concrete Floor and Slab Construction; 2004 (Errata 2007).
- F. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.
- G. ACI 305R - Hot Weather Concreting; 2010.
- H. ACI 306R - Cold Weather Concreting; 2010.
- I. ACI 308R - Guide to Curing Concrete; 2001 (Reapproved 2008).
- J. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.
- K. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.
- L. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2015a.
- M. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.
- N. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2013.
- O. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2012.
- P. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.
- Q. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2007.

- R. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2014.
- S. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.
- T. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.
- U. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2014.
- V. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2013.
- W. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2015.
- X. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2014.
- Y. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2010.
- Z. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014.
- AA. ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete; 2010a (Reapproved 2015).
- AB. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete; 2011.
- AC. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2013).
- AD. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting; 2015.
- AE. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- AF. ASTM F1249 - Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor; 2006 (Reapproved 2011).
- AG. ASTM E1155 - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers; 1996 (Reapproved 2008).
- AH. ASTM E1155M - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers (Metric); 1996 (Reapproved 2008).
- AI. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2011.
- AJ. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2011.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
 - 1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
- C. Mix Design: Submit proposed concrete mix design(s).

1. Submit reports for each concrete material and each mix design test. Reference Structural Notes for mix design requirements.
- D. Samples for Pigment Color Selection: Submit manufacturer's complete sample chip set, including pigment number and required dosage rate for each color.
- E. Samples: Submit samples of underslab vapor barrier to be used.
- F. Test Reports: Submit report for each test or series of tests specified.
- G. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.
- H. Construction and contraction joint layout drawings: Submit proposed layout of construction and contraction joints in foundations, concrete structural elements and systems, and slabs on grade showing compliance with the structure requirements and the specified criteria.

1.05 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Follow recommendations of ACI 306R when concreting during cold weather.

1.06 MOCK-UP

- A. Construct and erect mock-up panel for architectural concrete surfaces indicated to receive special treatment or finish as result of formwork.
 1. Panel Size: 4 by 2 feet (1.2192 by 0.61 meters).
- B. Accepted mock-up panel is considered basis of quality for the finished work. Keep mock-up exposed to view for duration of concrete work.
- C. Provide sample of custom colored concrete.
- D. Demolish mockup and remove from site when directed by SJCF.

PART 2 PRODUCTS

2.01 FORMWORK

- A. Comply with requirements of Section 03 10 00.

2.02 REINFORCEMENT

- A. Comply with requirements of Section 03 20 00.

2.03 CONCRETE MATERIALS

- A. Cement: 1, Type I and I/II Normal, Portland type.
 1. Acquire cement for entire project from same source.
- B. Fine and Coarse Aggregates: ASTM C 33.
 1. Acquire aggregates for entire project from same source.
 2. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
 3. Local aggregates not complying with ASTM C33/C33M that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to SJCF.
 4. Fine Aggregates: Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances.
 5. Coarse Aggregates: Clean, uncoated, processed from natural rock or stone containing no clay, loam or foreign matter. Unless otherwise noted or mass concrete, use aggregate meeting #57 or #67 grading requirements, except for toppings, aggregates shall meet #7 grading requirements.

- C. Fly Ash: ASTM C618, Class C.
 - 1. **Do not use fly ash in exposed, finished concrete.**
- D. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C979/C979M.
 - 1. Mixing of colorant for colored concrete shall occur at the plant. Job site or transit mixing of pigments will not be acceptable.
 - 2. Color(s): Match existing buff colored exterior wall panels. Color to be approved by Architect.
 - 3. Manufacturers:
 - a. BRICKFORM; BRICKFORM Liquid Integral Color: www.brickform.com/#sle.
 - b. Butterfield Color: www.butterfieldcolor.com/#sle.
 - c. Davis Colors: www.daviscolors.com/#sle.
 - d. Lambert Corporation: www.lambertusa.com/#sle.
 - e. Solomon Colors; Solomon ColorFlo Liquid Colors: www.solomoncolors.com/#sle.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Water: Clean, potable and not detrimental to concrete.

2.04 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
 - 1. Do not use calcium chloride or admixtures containing calcium chloride.
- B. Air Entrainment Admixture: ASTM C260/C260M.
- C. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.
- D. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
- E. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.
- F. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.
- G. Accelerating Admixture: ASTM C494/C494M Type C.
- H. Retarding Admixture: ASTM C494/C494M Type B.
- I. Water Reducing Admixture: ASTM C494/C494M Type A.

2.05 ACCESSORY MATERIALS

- A. Underslab Vapor Retarder: Multi-layer, fabric-, cord-, grid-, or aluminum-reinforced polyethylene or equivalent, complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.
 - 1. **Permeance of less than 0.010 Perms** per ASTM F1249 or ASTM E96/E96M.
 - 2. Thickness: 15 mils minimum.
 - 3. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations in vapor retarder.
 - 4. Manufacturers:
 - a. Insulation Solutions, Inc; Viper VaporCheck II 15-mil (Class A): www.insulationsolutions.com/#sle.
 - b. Poly-America; Husky Yellow Guard 15 mil Vapor Barrier: www.yellowguard.com/#sle.
 - c. Stego Industries, LLC; Stego Wrap Vapor Barrier - 15 mil: www.stegoindustries.com.
 - d. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils (0.38 mm): www.wrmeadows.com/#sle.

- e. Barrier-Bac; Barrier-Bac V350 (16 mil): www.barrierbac.com.
 - f. Raven Industries; Vaporblock 15 (15 mil): www.ravenind.com.
 - g. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
- 1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch (13.7 MPa).
 - 2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch (48 MPa).

2.06 BONDING AND JOINTING PRODUCTS

- A. See Section 03 10 00 Concrete Forming and Accessories
- B. Reglets: Formed steel sheet, galvanized, with temporary filler to prevent concrete intrusion during placement.
- 1. Size: As indicated on drawings.
 - 2. Size: 1/2 inch (12 mm) throat, 1/2 inch (12 mm) deep.
- C. Slab Isolation Joint Filler: 1/2 inch (13 mm) thick, height equal to slab thickness, with removable top section that will form 1/2 inch (13 mm) deep sealant pocket after removal.
- 1. Material: ASTM D1751, cellulose fiber.

2.07 CURING MATERIALS

- A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.
- 1. Manufacturers:
 - a. Dayton Superior Corporation; AquaFilm Concentrate J74: www.daytonsuperior.com/#sle.
 - b. Euclid Chemical Company ; EUCOBAR: www.euclidchemical.com/#sle.
 - c. SpecChem, LLC; SpecFilm Concentrate or SpecFilm RTU: www.specchemllc.com/#sle.
 - d. W. R. Meadows, Inc; Evapre or Evapre-RTU: www.wrmeadows.com/#sle.
 - e. Metalcrete Industries; Waterhold: www.metalcreteindustries.com.
 - f. L & M Construction Chemicals, Inc.; E-Con: www.lmcc.com.
 - g. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Curing and Sealing Compound, Moisture Emission Reducing: Liquid, membrane-forming, clear sealer, for application to newly placed concrete; capable of providing adequate bond for flooring adhesives, initially and over the long term; with sufficient moisture vapor impermeability to prevent deterioration of flooring adhesives due to moisture emission.
- 1. Use this product to cure and seal all slabs to receive adhesively applied flooring or roofing.
 - 2. Comply with ASTM C309 and ASTM C1315 Type I Class A.
 - 3. VOC Content: Less than 100 g/L.
 - 4. Solids Content: 25 percent, minimum.
- C. Curing and Sealing Compound: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C309 Type I Class B.
- 1. Application: Use at interior and exterior concrete and at applications approved by manufacturer.
 - 2. Vehicle: Water-based.
 - 3. Solids by Mass: 18 percent, minimum.
 - 4. VOC Content: OTC compliant.

5. Manufacturers:
 - a. Dayton Superior Corporation; Cure & Seal 309 EF: www.daytonsuperior.com/#sle.
 - b. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; Dress & Seal WB: www.lmcc.com/#sle.
 - c. SpecChem, LLC; Cure and Seal WB: www.specchemllc.com/#sle.
 - d. Metalcrete Industries; Metcure 0800: www.metalcreteindustries.com.
 - e. Euclid Chemical Company; Aqua-Cure VOX: www.euclidchemical.com.
 - f. W.R, Meadows, Inc.; VOCOMP-20: www.wrmeadows.com.
 - g. BASF Construction Chemicals; MasterKure CC 180 WB: www.buildingsystems.basf.com.
- D. Curing and Sealing Compound, Low Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.
 1. Application: Use at interior and exterior concrete and at applications approved by manufacturer.
 2. Vehicle: Solvent-based.
 3. Solids by Mass: 25 percent, minimum.
 4. VOC Content: OTC compliant.
 5. Manufacturers:
 - a. Dayton Superior Corporation; Cure & Seal 1315 J22WB: www.daytonsuperior.com/#sle.
 - b. Dayton Superior Corporation; Cure & Seal 1315 EF: www.daytonsuperior.com/#sle.
 - c. BASF Construction Chemicals; Kure 1315: www.buildingsystems.basf.com.
 - d. L & M Construction Chemicals; Dress & Seal WB 25: www.lmcc.com.
 - e. Metalcrete Industries; Metcure 30: www.metalcreteindustries.com.
 - f. SpecChem, LLC; Cure and Seal WB 25: www.specchemllc.com.
 - g. W. R. Meadows, Inc; VOCOMP-25: www.wrmeadows.com/#sle.
 - h. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Moisture-Retaining Sheet: ASTM C171.
 1. Curing paper, regular.
 2. Polyethylene film, clear, minimum nominal thickness of 0.0040 inch (0.10 mm).
 3. White-burlap-polyethylene sheet, weighing not less than 10 ounces per linear yard, 40 inches wide (305 g/sq m).
- F. Polyethylene Film: ASTM D2103, 4 mil (0.1 mm) thick, clear.
- G. Water: Potable, not detrimental to concrete.

2.08 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
 1. For trial mixtures method, employ independent testing agency acceptable to SJCF for preparing and reporting proposed mix designs.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
- D. Normal Weight Concrete:
 1. Compressive Strength, when tested in accordance with 1 at 28 days: As indicated on drawings.

2. Fly Ash Content: Maximum 20 percent of cementitious materials by weight. In no case shall the amount of the fly ash per cubic yard of concrete exceed 100 pounds (45 kg).
3. Water-Cement Ratio: Locations for each mix are scheduled on Structural Drawings.
 - a. Maximum 45 percent by weight for 4000 psi (27.6 MPa) and 4500 psi (31.1 MPa) concrete.
 - b. Maximum 50 percent by weight for 3500 psi (24.2 MPa) concrete.
 - c. Maximum 55 percent by weight for non-air-entrained 3000 psi (20.7 MPa) concrete.
 - d. Maximum 50 percent by weight for air-entrained 3000 psi (20.7 MPa) concrete.
4. Total Air Content: 4 - 7 percent, determined in accordance with ASTM C173/C173M.
 - a. For exterior exposed concrete.
5. Maximum Slump:
 - a. Ramps and sloping slab surfaces: not more than 3 inch (76 mm).
 - b. Reinforced foundation systems: not less than 3 inch (76 mm) and not more than 5 inch (127 mm).
 - c. Concrete containing high-range water-reducing admixture (superplasticizers): not more than 8 inch (203 mm) after adding admixture to site-verified 2 -3 inch (51 - 76 mm) slump concrete.
 - d. Other concrete: not less than 3 inch (76 mm) and not more than 5 inch (127 mm).
6. Aggregates: Proportion aggregates to provide a minimum of 50% coarse aggregate ratio to total aggregate.
7. Maximum Aggregate Size: 3/4 inch (19 mm), unless noted or approved otherwise.
8. Admixtures:
 - a. Use water-reducing admixture or high-range water-reducing admixture (superplasticizers) in concrete, as required, for placement and workability.
 - b. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).
 - c. Use mid-range or high-range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.
 - d. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content of 5 1/2 percent with a tolerance of plus or minus 1 1/2 percent.
 - e. Other concrete not exposed to freezing, thawing, or hydraulic pressure, or to receive a surface hardener: 2 to 4 percent air.
 - f. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

2.09 MIXING

- A. Transit Mixers: Comply with ASTM C 94/C 94M.
 1. The addition of water to a batch at the job site will only be allowed when the Owner, SJCF, Structural Engineer and the Contractor agree to the following defined criteria at the preconstruction meeting. This criteria must be strictly met when water is added to a batch at the job site.
 - a. Water shall only be allowed to be added to a batch at the site if the measured concrete slump is less than 3 inch (76.2 mm).
 - b. When allowed, water should only be added once to the batch on-site and the addition of the water must be completed within 15 minutes from the start of the water addition.

- c. The on-site added water must be properly mixed to ensure that a homogenous mixture is attained.
 - d. The maximum amount of water which may be added to the batch on-site is 1 gallon (3.78 liter) of water per 1 cu. yd. (0.76 cu. m) of concrete.
 - e. After the on-site added water has been added to the batch and the batch has been properly mixed, the concrete shall have a measured slump within the defined slump range of 3 inches (76.2 mm) to 5 inches (127 mm)
 - f. Concrete shall be rejected if the slump, after the addition of on-site water, does not occur with the slump range of 3 inches (76.2 mm) to 5 inches (127 mm) or is deemed unacceptable for placement.
 - g. The field testing and inspection agency or and approved Representative of the Owner shall monitor the implementation of the slump measurements and the water addition procedures.
2. When air temperature is between 85 deg F (29 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1 1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

- A. Verify that forms are clean and free of rust before applying release agent.
- B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- C. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
- D. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.
- E. In locations where new concrete is doveled to existing work, drill holes in existing concrete, insert steel dowels in holes filled with an approved epoxy or adhesive.
- F. Install Vapor Barrier in accordance with Manufacturer's printed instructions and ASTM E1643 directly on top of sand or granular course.
 1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
 2. **Extend vapor barrier to the perimeter of the slab.** If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, water stops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.
 3. **Continue vapor barrier past end of slab pour where it will abut an additional slab pour. Allow for the minimum lap for a complete continuation of the vapor barrier under the building's slab.**

4. Lap joints 6 inch (152 mm) minimum and seal with Manufacturer's seam tape. Apply seam tape to clean and dry vapor barrier.
5. No penetration of the vapor barrier permitted except at reinforcing and permanent utilities. Install pipe boots at permitted locations.
6. Avoid the use of stakes driven through vapor barrier by utilizing screed and forming systems that will not leave punctures in the vapor barrier.
7. Inspect membrane after reinforcing has been placed and immediately prior to placing concrete.
8. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.

3.03 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Notify SJCF not less than 24 hours prior to commencement of placement operations.
- D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- E. Ensure reinforcement, inserts, waterstops, and embedded parts will not be disturbed during concrete placement.
 1. Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.
 2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.
 3. Install dovetail anchor slots in concrete structures as indicated on drawings
- F. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.
- G. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.
- H. Repair underslab vapor barrier damaged during placement of concrete reinforcing. Repair with vapor barrier material; lap over damaged areas minimum 6 inches (150 mm) and seal watertight.
- I. Cold-Weather Placement: Comply with ACI 306R 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 (4.4 deg C) 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.
- J. Hot-Weather Placement: Comply with ACI 305R and as follows:
 1. Maintain concrete temperature below 90 deg F (32 deg C) 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.

3.04 SLAB JOINTING

- A. Anchor joint fillers and devices to prevent movement during concrete placement.
- B. Construction Joints
 1. Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to SJCF.
 2. Do not locate construction joints across rooms where any type of flooring will be applied except in inconspicuous places such as end of corridors, edge of walls, at doorways, etc.
 3. Provide keyways at least 1 1/2 inch (38 mm) deep in construction joints between slabs and where detailed. Bulkheads designed and accepted for this purpose may be used for slabs.
 4. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise.
 5. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- C. Isolation Joints in Slabs-on-Grade
 1. Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
- D. Contraction (Control) Joints in Slabs-on-Grade
 1. General: Construct contraction joints in slabs-on-grade to form panels of patterns as noted or shown. Use tool cuts 1/8 inch (3 mm) wide by one-fourth of slab depth or inserts 1/4 inch (6 mm) wide by one-fourth of slab depth or saw cutting to a depth not less than 10 percent of slab thickness with a 1 inch (25 mm) minimum depth.
 2. Tooled Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate grooved tool marks on concrete surfaces. Tool edges in exposed slabs.
 3. Saw cutting of floor slabs, curbs and vehicle paving:
 - a. Slabs may be sawed if cut immediately and within 2 hours following final troweling using a "Soff-cut" saw or early entry dry-cutting saw system. Install cuts as soon as concrete will support weight of saw and operator without disturbing final finish.
 4. Inserts: Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
 5. If joint pattern is not shown, provide joints not exceeding 15 feet (4.5 m) in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
- E. Placing Concrete in Forms
 1. Deposit concrete in forms in horizontal layers no deeper than 24 inch (600 mm) and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

2. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inch (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.
- F. Placing Concrete Slabs
1. Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.
 2. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
 3. Maintain reinforcing in proper position on chairs during concrete placement.
 4. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of lumps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

3.05 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:
1. All Floors: F(F) of 25; F(L) of 20.
 2. At Polished Concrete Floors: F(F) of 50; F(L) of 45.
 - a. See Section 03 35 36 for additional requirements.
- B. Measure F(F) Floor Flatness and F(L) Floor Levelness in accordance with ASTM E1155 (ASTM E1155M), within 48 hours after slab installation; report both composite overall values and local values for each measured section.
- C. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.
- D. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.06 CONCRETE FINISHING

- A. Repair surface defects, including tie holes, immediately after removing formwork.
- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch (6 mm) or more in height.
- C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch (6 mm) or more in height. For surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. Provide finish as follows:
1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
 2. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.
 - a. Combine one part portland cement to one and one-half parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint. Blend standard

- portland cement and white portland cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.
3. Cork Floated Finish: Immediately after form removal, apply grout with trowel or firm rubber float; compress grout with low-speed grinder, and apply final texture with cork float.
- D. Exposed Sandblast Finish: Repair and patch defective areas and remove and smooth fins or other projections. After preparation lightly sandblast the surfaces exposed to view from normal walking level viewing. Remove the surface laitance or cement paste to open the surface of the cast concrete as approved by the Architect before commencing the work.
1. Time (concrete age) for sandblasting of exposed finished work shall be determined by testing on concealed concrete surfaces at different ages. Blasting may be done as early as 3 days after placing but not prior to concrete gaining 2000 psi (13.8 MPa) strength. Other considerations will be given to longer cure, etc. as help in minimizing staining and finish surface protection.
- E. 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.
- F. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
1. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.
 2. Decorative Exposed Surfaces: Trowel as described in ACI 302.1R; use steel-reinforced plastic trowel blades instead of steel blades to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed, pigmented concrete, and surfaces to be polished.
 - a. Steel-Reinforced Plastic Trowel Blade Manufacturer: Wagman Metal Products, Inc: www.wagmanmetal.com/#sle.
 - b. After slab has cured and at the time of substantial completion, thoroughly clean and buff exposed concrete floor surfaces and recoat with Curing and Sealing compound per manufacturer's instructions.
 3. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.
 - a. Sealer: After slab has cured and at the time of substantial completion, thoroughly clean and buff exposed concrete floor surfaces and recoat with Curing and Sealing Compound per manufacturer's instructions.
 4. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.
 5. Non-Slip Broom Finish: Apply a nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - a. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with SJCF before application.
- G. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.
1. Approve floor drain elevations with SJCF prior to pouring floors. Drain elevations shall be coordinated with type and size of floor tile or other scheduled floor finish.
 2. At individual showers, set top of drains 3/4 inch (19 mm) below floor elevation.

3.07 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. 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.

3.08 CURING AND PROTECTION

- A. Comply with requirements of ACI 308R. 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.
- C. Evaporation Retarder: In hot, dry, and windy weather apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq ft x h (1 kg/sq m x h) before and during finishing operations. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.
- D. Formed Surfaces: Cure by moist curing with forms in place for full curing period.
 - 1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
- E. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- F. Cure concrete according to ACI 308R, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12 inch (300 mm) lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inch (300 mm), 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.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound

manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. 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.

3.09 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
 1. Contractor may perform field tests and cast compression test specimens if specimens are prepared and handled by person(s) trained and CERTIFIED for sampling concrete.
- C. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
- D. Compressive Strength Tests:
 1. For each test, mold and cure four concrete test cylinders. Obtain test samples for every 50 cubic yards (38 cu m) or less of each class of concrete placed.
 1. One specimen tested at 7 days, two specimens tested at 28 days and one specimen retained in reserve for later testing if required.
- E. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
- F. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.
- G. Air Content Test: ASTM C173/C173M, volumetric method for lightweight or normal weight concrete; ASTM C231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
- H. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
- I. Test Results: The testing agency shall report test results in writing to SJCF and Contractor within 24 hours of test.
 1. Reports of compressive strength tests shall contain the following:
 - a. Project identification name and number
 - b. Date of concrete placement
 - c. Name of concrete testing service
 - d. Concrete type and class
 - e. Location of concrete batch in structure
 - f. Design compressive strength at 28 days
 - g. Concrete mix proportions and materials
 - h. Compressive breaking strength
 - i. Type of break for both 7-day tests and 28-day tests
 - j. Site measured slump, temperature and air-content

3.10 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

1. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
 2. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi (3.4 MPa).
- B. Repair or replacement of defective concrete will be determined by SJCF. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
1. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
 2. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by SJCF. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M, or by other methods as directed.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of SJCF for each individual area.

3.11 PROTECTION

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.

3.12 SCHEDULE - CONCRETE FINISHES

- A. Integral Colored Concrete: Install at exterior site retaining walls.

END OF SECTION

SECTION 03 45 00 - PRECAST ARCHITECTURAL CONCRETE**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Architectural precast concrete wall panels.
- B. Architectural precast concrete accessories.
- C. Supports, anchors, and attachments.
- D. Grouting under panels.

1.02 RELATED REQUIREMENTS

- A. Section 03 20 00 - Concrete Reinforcing.
- B. Section 03 30 00 - Cast-in-Place Concrete: Admixtures.
- C. Section 07 21 00 - Thermal Insulation: Integral insulation.
- D. Section 07 62 00 - Sheet Metal Flashing and Trim: Reglets recessed in units.
- E. Section 07 92 00 - Joint Sealants: Sealing perimeter and intermediate joints.

1.03 REFERENCE STANDARDS

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).
- B. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).
- C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.
- G. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric]; 2007.
- H. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
- I. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.
- J. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.
- K. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2012.
- L. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.
- M. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.
- N. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2010.
- O. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.
- P. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- Q. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2011.
- R. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products; 2007.

- S. PCI MNL-120 - PCI Design Handbook - Precast and Prestressed Concrete; 2010, Seventh Edition.
- T. PCI MNL-122 - Architectural Precast Concrete; 2007, Third Edition.
- U. PCI MNL-123 - Design and Typical Details of Connections for Precast and Prestressed Concrete; 1988, Second Edition.
- V. PCI MNL-124 - Design for Fire Resistance of Precast Prestressed Concrete; 1989, Second Edition.
- W. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction; 2000.
- X. UL (FRD) - Fire Resistance Directory; current edition.

1.04 DESIGN REQUIREMENTS

- A. Design units to withstand design loads as calculated in accordance with applicable IBC code, and erection forces. Calculate structural properties of units in accordance with ACI 318.
- B. Design units to withstand static loads and anticipated dynamic loading, including positive and negative wind loads and thermal movement loads.
- C. Fire Resistance: Provide designs tested to provide ratings as indicated on the code plan and drawings.
 - 1. Fire-Test-Response Characteristics: Provide structural precast concrete units that comply with the following requirements.
 - a. Fire-response tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency includes UL or another agency that is acceptable to authorities having jurisdiction and performs testing and follow-up services.
 - b. Fire-resistance-rated assemblies indicated are identical in materials and construction to those tested for fire resistance per ASTM E119.
 - c. Fire-resistance-rated assemblies are indicated by design designations listed in the UL (FRD) or in the listings of another qualified testing and inspecting agency.
 - d. Products are identified with appropriate markings of applicable testing and inspecting agency.
- D. Design units to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
- E. Design component connections to accommodate building movement and thermal movement. Provide adjustment to accommodate misalignment of structure without unit distortion or damage.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's information on accessory products, including pigments, admixtures, inserts, plates, etc.
- C. Shop Drawings: Indicate layout, unit locations, configuration, unit identification marks, reinforcement, integral insulation, insulated panel system connectors, connection details, support items, location of lifting devices, dimensions, openings, and relationship to adjacent materials. Provide erection drawings.
 - 1. Include details of mix designs.

2. Show layout, dimensions, and identification of each precast unit corresponding to the sequence and procedure of installation. Indicate welded connections by AWS standard symbols. Detail inserts, connections, and joints, including accessories and construction at openings in precast units.
 3. Show location and details of anchorage devices that are to be embedded in other construction. Furnish templates if required for accurate placement.
 4. Submit written reports to SJCF of proposed mix for each type of concrete at least 15 days prior to start of precast unit production. Do not begin concrete production until mixes and evaluations have been approved by SJCF.
 5. Provide elevations indicating all j-box locations and embedded conduit runs, duct locations and piping penetrations. E.C. and M.C. to coordinate.
- D. Samples: Submit two samples, 12 by 12 inch (305 by 305 mm) in size, illustrating surface finish, color and texture.
1. Architect's review of samples will be for color, texture and general condition only. Compliance with all other requirements is the exclusive responsibility of the Contractor and Fabricator
- E. Design Data: Submit design data reports indicating calculations for loadings and stresses of fabricated, erected and designed members and connections.
1. Submit calculated fire-resistance requirements.
 2. Include structural analysis data sealed and signed by the qualified professional engineer responsible for their preparation, licensed in Kansas.
- F. Maintenance Data: Indicate surface cleaning instructions.

1.07 QUALITY ASSURANCE

- A. Design Engineer Qualifications: Design precast concrete units and connections under direct supervision of a Professional Structural Engineer experienced in design of precast concrete and licensed in Kansas.
1. Design anchorage and anchor devices for both the building structure and precast members. Building design criteria: wind loading, seismic requirements, horizontal and vertical loads, as required by International Building Code. Designate handling and transportation loadings used in design.
- B. Perform the work of this section in accordance with PCI MNL-117, PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135 and ACI 318. Perform welding in accordance with AWS D1.1/D1.1M.
- C. Fabricator Qualifications:
1. Firm having at least 5 years of experience in production of precast concrete of the type required.
 2. Plant certified under Precast/Prestressed Concrete Institute Plant Certification Program; product group and category A1 - Architectural Precast Concrete.
 3. Fabricator must have sufficient capability to design, produce, transport, and deliver the required units in accordance with the approved schedule without causing delay in the work.
 4. Produce precast concrete units at a fabricating plant engaged primarily in the manufacturing of similar units, unless plant fabrication is impractical.
 5. If units are produced at locations other than precast concrete fabricating plants, maintain procedures and conditions for quality control which are equivalent to plant production.
 6. Institute quality control procedures for the manufacture, inspection, and testing of precast units in compliance with recommendations of PCI. Furnish SJCF and Contractor copies of test reports and/or certifications for materials and quality control testing of precast units.

7. Fabricate pieces at one time from materials from one source to assure a uniformity of color, texture, and materials.
- D. Welder Qualifications: Qualified within previous 12 months in accordance with AWS D1.1/D1.1M and AWS D1.4/D1.4M.

1.08 MOCK-UP

- A. Provide complete mock-up, 4 feet (1.5 m) long by 4 feet (1.5 m) wide, with lifting device, and attachment points, and finish in accordance with approved sample.
- B. After approval of surface finish samples, construct, and deliver to the site, a sample or samples which will illustrate the various conditions of the fabricated panels. Include such features as window and door returns, mitered corner, false joint, panel joint, exposed face and edge, multi-face exposed finish piece, top of panel and the like. Prepare pieces so they can be erected, be self supporting and such that joints will illustrate erected panel conditions.
- C. Locate where directed.
- D. Demolish mockup and remove from site when directed by SJCF.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Handling: Lift and support precast units only from support points.
- B. Blocking and Lateral Support During Transport and Storage: Use materials that are clean, non-staining, and non-harmful to exposed surfaces. Provide temporary lateral support to prevent bowing and warping.
- C. Protect units to prevent staining, chipping, or spalling of concrete.
- D. Removal of units from trucks is a part of the Installation Work. Cooperate with those parties performing this work.
- E. Provide yard storage for fabricated units, as needed if project site storage area is not adequate, to assure timely sequence and delivery.
- F. Provide permanent markings in precast units to identify pick-up points and orientation in the structure, complying with the markings indicated on the final shop drawings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Architectural Precast Concrete:
 1. Any manufacturer holding a PCI Group A Plant Certification for the types of products specified; see www.pci.org/#sle.
 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PRECAST UNITS, GENERAL

- A. Precast Architectural Concrete Units: Comply with PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI 318.
 1. Concrete Face Mix: Minimum 5000 psi (34 MPa), 28 day strength, air entrained to 4 to 6 percent; comply with ACI 301.
 - a. Comply with the applicable requirements of ACI 211.1, using either laboratory trial batch or field test data methods to design concrete.
 - b. Limit use of fly ash to a maximum 20 percent of cementitious materials by weight. In no case shall the amount of the fly ash per cubic yard of concrete exceed 100 pounds (45 kg).
 2. Design Loads: Static loads, anticipated dynamic loading, including positive and negative wind loads, thermal movement loads, and erection forces as defined by applicable code.

3. Calculate structural properties of units in accordance with ACI 318.
4. Fire Resistance: Provide designs tested to provide ratings as indicated on the code plan and drawings.
 - a. Fire-Test-Response Characteristics: Provide structural precast concrete units that comply with the following requirements.
 - 1) Fire-response tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency includes UL or another agency that is acceptable to authorities having jurisdiction and performs testing and follow-up services.
 - 2) Fire-resistance-rated assemblies indicated are identical in materials and construction to those tested for fire resistance per ASTM E119.
 - 3) Fire-resistance-rated assemblies are indicated by design designations listed in the UL (FRD) or in the listings of another qualified testing and inspecting agency.
 - 4) Products are identified with appropriate markings of applicable testing and inspecting agency.
 5. Accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
 6. Provide connections that accommodate building movement and thermal movement and adjust to misalignment of structure without unit distortion or damage.
- B. Finish Type A: Ensure exposed-to-view finish surfaces of precast units are uniform in color and appearance, matching existing building panels in color and sandblasted texture.

2.03 REINFORCEMENT

- A. Comply with requirements of Section 03 20 00.

2.04 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
 1. Use white or colored Portland cement for facing concrete mix to match design sample.
- B. Fine and Coarse Structural Aggregates: ASTM C33/C33M.
- C. Surface Finish Aggregate: To match existing building and as approved by SJCF.
- D. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C979/C979M.
 1. Concentration: Base dosage rates on weight of Portland cement, fly ash, silica fume, and other cementitious materials but not aggregate or sand.
 2. Color(s): To match SJCF's sample(s) when incorporated into specified mix design(s).
 3. Color: To match existing building and as approved by SJCF.
 4. Manufacturers:
 - a. Butterfield Color: www.butterfieldcolor.com/#sle.
 - b. Davis Colors: www.daviscolors.com/#sle.
 - c. Lambert Corporation: www.lambertusa.com/#sle.
 - d. Solomon Colors: www.solomoncolors.com.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Water: Clean and not detrimental to concrete.
- F. Admixtures: Air entrainment as specified in Section 03 30 00.
- G. Grout:
 1. Non-shrink, non-metallic, minimum 10,000 psi (70 MPa), 28 day strength.

2.05 SUPPORT DEVICES

- A. Connecting and Support Devices; Anchors and Inserts: ASTM A36/A36M steel; hot-dip galvanized in accordance with ASTM A153/A153M.
 - 1. Clean surfaces of rust, scale, grease, and foreign matter.
 - a. Delivery Inspection and Cleaning: Fabricator clean exposed facings to remove dirt and stains which may be on the units at time units are removed from the trucks. Wash and rinse in accordance with precast manufacturer's recommendations. Do not use cleaning materials or processes which could change the character of the exposed concrete finishes. Inspect and make repairs or replace unsatisfactory precast units as required. Units may be accepted conditional to satisfactory cleaning and repair being made after erection. Also comply with Performance Requirements.
 - b. Cleaning after Erection: Clean exposed facings to remove dirt and stains which may be on the units after erection and completion of joint treatments. Wash and rinse in accordance with precast manufacturer's recommendations. Protect other work from damage due to cleaning operations. Do not use cleaning materials or processes which could change the character of the exposed concrete finishes
 - 2. Prime paint in one coat, except surfaces in direct contact with concrete or requiring field welding.
 - a. Use galvanizing repair coating on galvanized surfaces.
 - b. Following installation of loose steel clean welds and paint surfaces of steel connection devices, both loose and embedded, before covering them by subsequent construction.
- B. Bolts, Nuts, and Washers: ASTM A307 heavy hex bolts, Type A, hot-dip galvanized, with matching ASTM A563 (ASTM A563M) nuts and matching washers.
- C. Primer: Zinc rich type.
 - 1. Provide primer for field touch-up of completed anchorages.

2.06 ACCESSORIES

- A. Bearing Pads: Random-Oriented, Fiber Reinforced Elastomeric Pads; Shore A Durometer 70-90; 1/2 inch (13 mm) thick or as required, smooth both sides.
 - 1. JVI Inc; Masticord: www.jvi-inc.com .
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Reglets: Specified in Section 07 62 00.

2.07 FABRICATION

- A. Fabricate in conformance with PCI MNL-117 and PCI MNL-135.
- B. Maintain plant records and quality control program during production of precast units. Make records available upon request.
- C. Use rigid molds, constructed to maintain precast unit uniform in shape, size, and finish.
- D. Use form liners in accordance with manufacturer's instructions.
- E. Maintain consistent quality during manufacture.
 - 1. Precast units which are warped, cracked, broken, spalled, stained or otherwise defective will not be acceptable.
- F. Fabricate connecting devices, plates, angles, items fit to steel framing members, inserts, bolts, and accessories. Fabricate to permit initial placement and final attachment.
 - 1. Cast-in openings larger than 10 inch (250 mm).
- G. Embed reinforcing steel, anchors, inserts plates, angles, and other cast-in items.

1. Furnish all loose steel, plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other miscellaneous steel shapes necessary for securing precast units to other units supporting structure and other elements as indicated.
- H. Place recessed flashing reglets continuous and straight.
- I. Locate hoisting devices to permit removal after erection.
- J. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.
- K. Minor patching in plant is acceptable, providing structural adequacy and appearance of units is not impaired.

2.08 FABRICATION TOLERANCES

- A. Conform to PCI MNL-117 and PCI MNL-135, except as specifically amended below.
 1. Maximum Variation From Nominal Face Dimensions: Plus or minus 3/32 in (2.4 mm).
 2. Maximum Variation From Square or Designated Skew: Plus or minus 1/8 inch in 10 feet (1 mm per m).
 3. Maximum Variation from Thickness: Plus or minus 1/8 in (3 mm).
 4. Maximum Misalignment of Anchors, Inserts, Openings: Plus or minus 1/8 inch (3 mm).
 5. Maximum Bowing of Members: Plus or minus length/360.

2.09 SOURCE QUALITY CONTROL

- A. The Owner may employ an independent testing agency to evaluate precast fabricator's quality control and testing methods.
 1. In accordance with the Contract, the Contractor shall pay for all tests showing deficiencies, otherwise Owner shall be responsible for payment.
 2. Allow Owner's testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Owner's testing agency and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.
- B. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL-117 requirements.
 1. Strength of precast concrete units will be considered potentially deficient when precast concrete units fail to comply with requirements, including the following:
 - a. Fail to meet compressive-strength test requirements.
 - b. Reinforcement, and pretensioning and detensioning tendons of prestressed concrete do not conform to fabrication requirements.
 - c. Concrete curing and protection of precast units against extremes in temperature fail to meet requirements.
 - d. Precast units are damaged during handling and erecting.
- C. Testing: When there is evidence that the strength of precast concrete units may be deficient or may not meet requirements, the Precaster will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C42.
 1. A minimum of 3 representative cores will be taken from precast concrete units of suspect strength, from locations directed by Architect.
 2. Cores will be tested, following immersion in water, in a wet condition per ACI 301 when precast concrete units will be wet under service conditions.
 3. Cores will be tested in an air-dry condition per ACI 301 when precast concrete units will be dry under service conditions.

4. Strength of concrete for each series of 3 cores will be considered satisfactory if the average compressive strength is at least 85 percent of the 28-day design compressive strength and no core compressive strength is less than 75 percent of the 28-day design compressive strength.
 5. Test results will be made in writing on the same day that tests are made, with copies to SJCF, Contractor, and precast fabricator. Test reports will include the Project identification name and number, date, name of precast concrete fabricator, name of concrete testing agency; identification letter, name, and type of precast concrete unit or units represented by core tests; design compressive strength, compressive strength at break and type of break, corrected for length-diameter ratio, and direction of applied load to core with respect to horizontal plane of concrete as placed.
- D. Patching: Where core test results are satisfactory and precast concrete units meet requirements, solidly fill core holes with patching mortar and finish to match adjacent concrete surfaces.
- E. Defective Work: Precast concrete units that do not conform to requirements, including strength, manufacturing tolerances, and finishes, are unacceptable. Replace with precast concrete units that meet requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that building structure, anchors, devices, and openings are ready to receive work of this section.

3.02 PREPARATION

- A. Provide for erection procedures and induced loads during erection. Maintain temporary bracing in place until final support is provided.

3.03 ERECTION

- A. Erect units without damage to shape or finish. Replace or repair damaged panels.
- B. Erect units level and plumb within allowable tolerances.
- C. Align and maintain uniform horizontal and vertical joints as erection progresses.
- D. When units require adjustment beyond design or tolerance criteria, discontinue affected work; advise SJCF.
- E. Fasten units in place with mechanical connections, grouting or welding according to the Shop Drawings. Perform welding in accordance with AWS D1.1/D1.1M.
- F. Provide non-combustible shields during welding operations.
- G. Touch-up field welds and scratched or damaged primed painted surfaces.
- H. Set vertical units dry, without grout, attaining joint dimension with lead or plastic spacers. Pack grout to base of unit.
- I. Exposed Joint Dimension: 1/2 inch (12 mm). Adjust units so that joint dimensions are within tolerances.
- J. Seal perimeter and intermediate joints in accordance with Section 07 92 00.

3.04 TOLERANCES

- A. Erect members level and plumb within allowable tolerances. Conform to PCI MNL-135, except as specifically amended below.
1. Plan Location from Building Grid Datum: Plus or minus 3/8 in (9.5 mm).
 2. Top Elevation from Nominal Top Elevation: Plus or minus 3/8 inch (9.5 mm).

3. Maximum Plumb Variation Over Height of Structure or 100 ft (30 m) (whichever is less): Plus or minus 1/2 inch (12.5 mm).
4. Exposed Joint Dimension: Plus or minus 3/16 inch (4.5 mm).
5. Maximum Jog in Alignment of Matching Faces or Edges: Plus or minus 3/16 inch (4.5 mm).
6. Differential Bowing or Camber as Erected Between Similar Adjacent Members: Plus or minus 3/16 inch (4.5 mm).

END OF SECTION

SECTION 04 05 11 - MORTAR AND MASONRY GROUT**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Mortar for masonry.
- B. Grout for masonry.

1.02 RELATED REQUIREMENTS

- A. Section 04 20 00 - Unit Masonry: Installation of mortar and grout.
- B. Section 08 11 13 - Hollow Metal Doors and Frames: Products and execution for grouting steel door frames installed in masonry.

1.03 REFERENCE STANDARDS

- A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.
- B. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.
- C. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.
- D. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.
- E. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).
- F. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.
- G. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar; 2011b.
- H. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.
- I. ASTM C476 - Standard Specification for Grout for Masonry; 2010.
- J. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2012.
- K. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2010.
- L. ASTM C1019 - Standard Test Method for Sampling and Testing Grout; 2013.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include design mix for each type of mortar and grout.
- C. Reports: Submit reports on mortar indicating conformance of mortar to property requirements of ASTM C270 and test and evaluation reports per ASTM C780.
- D. Reports: Submit reports on grout indicating conformance of component grout materials to requirements of ASTM C476 and test and evaluation reports to requirements of ASTM C1019.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.
 - 1. Do not use cementitious materials that have become damp.

2. 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

1.06 FIELD CONDITIONS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

- A. At Contractor's option, mortar and grout may be field-mixed from packaged dry materials, made from factory premixed dry materials with addition of water only, or ready-mixed.
- B. Mortar Color: Color pigmented at exposed burnished interior block and interior veneer masonry.
 1. Use color pigmented mortar at interior veneer.
- C. Mortar Mix Designs: ASTM C270, Property Specification.
 1. Exterior and Interior Masonry Veneer: Type N.
 2. Interior, Non-loadbearing Masonry: Type S.
- D. Grout Mix Designs:
 1. Bond Beams, Lintels, and other structural components: 2,500 psi (17.5 MPa) strength at 28 days; 8-10 inches (200-250 mm) slump; mix in accordance with ASTM C476.
 - a. Fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm) or less.
 - b. Coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm).

2.02 MATERIALS

- A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C387/C387M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
 1. Type: Types as scheduled in this section.
 2. Manufacturers:
 - a. Amerimix, an Oldcastle brand: www.amerimix.com/#sle.
 - b. Spec Mix: www.specmix.com.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.
 1. Type: Types as scheduled in this section.
 2. Manufacturers:
 - a. Amerimix, an Oldcastle brand: www.amerimix.com/#sle.
 - b. Spec Mix: www.specmix.com.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Portland Cement: ASTM C150/C150M.
 1. Type: Type I - Normal; ASTM C150/C150M.
- D. **Masonry Cement is not allowed.**

- E. Hydrated Lime: ASTM C 207, Type N or S.
- F. Mortar Aggregate: ASTM C144.
 - 1. Natural sand; clean, hard, free from clay, loam, lignite, shale, dust, and organic matter.
- G. Grout Aggregate: ASTM C404.
- H. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
 - 1. Color(s): As selected by SJCF from manufacturer's full range.
 - 2. Manufacturers:
 - a. Solomon Colors; Solomon Colors Concentrated A, H, and X Series: www.solomoncolors.com/#sle.
 - b. Davis Colors; True Tone: www.daviscolors.com/#sle.
 - c. Lambert Corporation; Lambco Colors: www.lambertusa.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- I. Water: Clean and potable.

2.03 MORTAR MIXING

- A. Ready Mixed Mortar: ASTM C1142, Type equivalent to that specified according to ASTM C270.
- B. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.
 - 1. Measure proportions accurately in devices built to measure ingredients for one batch for mixer used.
 - 2. Mix mortar in mechanical mixer 5 minutes minimum.
 - 3. Use within 2 hours after mixing.
- C. Maintain sand uniformly damp immediately before the mixing process.
- D. Colored Mortar: Proportion selected pigments and other ingredients to match SJCF's sample, without exceeding manufacturer's recommended pigment-to-cement ratio; mix in accordance with manufacturer's instructions, uniform in coloration.
- E. Do not use admixtures, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
- F. If water is lost by evaporation, re-temper only within two hours of mixing.
 - 1. Do not re-temper or use partially set mortar.
 - 2. Do not use frozen or caked materials.

2.04 GROUT MIXING

- A. Mix grout in accordance with ASTM C94/C94M.
- B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.
- C. Add admixtures in accordance with manufacturer's instructions; mix uniformly.
- D. Do not use anti-freeze compounds to lower the freezing point of grout.

2.05 PRECONSTRUCTION TESTING

- A. Testing will be conducted by an independent test agency, in accordance with provisions of Section 01 40 00 - Quality Requirements.
- B. Mortar Mixes: Test mortars prebatched by weight in accordance with ASTM C780 recommendations for preconstruction testing.
 - 1. Test results will be used to establish optimum mortar proportions and establish quality control values for construction testing.

- C. Grout Mixes: Test grout batches in accordance with ASTM C1019 procedures.
 - 1. Test results will be used to establish optimum grout proportions and establish quality control values for construction testing.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install mortar and grout to requirements of section(s) in which masonry is specified.
- B. Work grout into masonry cores and cavities to eliminate voids.
- C. Do not install grout in lifts greater than 48 inches (1219 mm).
 - 1. At continuous vertical cores stop the grout pour a minimum of 1 1/2 inch (38 mm) below the top block of each pour to create a keyway for the next pour to lock into the lower poured core. Pour to the top of the block at the top of walls, below bond beams, beam bearing locations or similar locations.
- D. Do not displace reinforcement while placing grout.
- E. Remove excess mortar from grout spaces.
- F. Consolidate grout at the time of placement by mechanical vibration or puddling. Reconsolidate grout by mechanical vibration after initial water loss and settlement has occurred.

3.02 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field tests, in accordance with provisions of Section 01 40 00 - Quality Requirements.
- B. Test and evaluate mortar in accordance with ASTM C780 procedures.
 - 1. Test frequency: One random test each week during the masonry work unless frequency is approved by SJCF.
- C. Test and evaluate grout in accordance with ASTM C1019 procedures.
 - 1. Test frequency: Two random tests each week during the masonry work unless less frequency is approved by SJCF.

END OF SECTION

SECTION 04 20 00 - UNIT MASONRY**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Concrete Block.
- B. Clay Facing Brick.
- C. Reinforcement and Anchorage.
- D. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 20 00 - Concrete Reinforcing: Reinforcing steel for grouted masonry.
- B. Section 04 05 11 - Mortar and Masonry Grout.
- C. Section 05 50 00 - Metal Fabrications: Loose steel lintels.
- D. Section 07 19 00 - Water / Grafitti Repellents: Water repellents applied to interior masonry surfaces.
- E. Section 07 84 00 - Firestopping: Firestopping at penetrations of fire-rated masonry and at top of fire-rated walls.
- F. Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

- A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
- D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.
- E. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2014.
- F. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2014.
- G. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2011.
- H. ASTM C140/C140M - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units; 2014.
- I. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.
- J. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2014.
- K. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2012.
- L. ASTM C1072 - Standard Test Method for Measurement of Masonry Flexural Bond Strength; 2013.
- M. ASTM C1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar; 1992a (Reapproved 2008).
- N. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2014.
- O. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.

- P. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2014.
- Q. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.
- R. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, and masonry accessories.
- C. Samples: Submit four samples of decorative block and facing brick units to illustrate color, texture, and extremes of color range.
- D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
- E. Test Reports: Concrete masonry manufacturer's test reports for units.
 - 1. Submit test report made within 12 months of anticipated first delivery of block for the project showing compliance with quality and type units specified.
 - 2. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - 3. For block, include data and calculations establishing average net-area compressive strength of units.
- F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.05 QUALITY ASSURANCE

- A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.
- B. Defective Units:
 - 1. For brick: brick with cracks in exposed faces of the unit shall be rejected.
 - 2. For block: in accordance with the ASTM C90 specification "Where units are to be used in exposed wall construction, the face or faces that are to be exposed shall be free of chips, cracks, or other imperfections." The then allowable 5% of a shipment which "contains slight cracks or small chips" may be used in unexposed faces or shall be culled. No defects impairing strength or permanence shall be employed.
- C. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

1.06 MOCK-UP

- A. Construct a masonry wall as a mock-up panel sized 8 feet (2.4 m) long by 6 feet (1.8 m) high; include mortar, accessories, structural backup, wall openings, and brick/stone pattern in mock-up.
- B. Locate where directed.
- C. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS**2.01 CONCRETE MASONRY UNITS**

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 x 8 inches (400 x 200 mm) and nominal depth of 4 inches (100mm), 6 inches (150 mm), 8 inches (200 mm) and 12 inches (300 mm) as indicated, 2 cell units.
 - 2. Special Shapes: Provide non-standard blocks configured for corners, lintels, and headers.
 - a. Provide bullnose block units required at outside corners, door and window jambs and as otherwise detailed. Provide square corner units at locations designated for wall tile and at 6" block where 5 3/4" HM frame depths occur.
 - b. Provide lintel or channel U-shaped block for lintels above openings exposed to view. Bond beams with the bottom cores filled is not acceptable.
 - c. Provide bond beam blocks where indicated on the drawings.
 - 3. Types:
 - a. Use 16 x 8 inch (400 x 200 mm) 2 cell units in typical locations except where burnished block is noted on wall schedule.
 - b. Provide sash blocks to accept rubber joint at control joints where indicated on plans.
 - 4. Load-Bearing Units: ASTM C90, lightweight, 30 pound (13.6 kg) maximum weight.
 - a. All 6 and 8 inch (152 and 203 mm) units shall have a minimum compressive strength of 1900 psi (13.1 MPa) on the net area at 28 days and a net area compressive strength of masonry of 1500 psi (10.3 MPa).
 - b. Exposed Faces: Manufacturer's standard color and texture where indicated.

2.02 ARCHITECTURAL CONCRETE MASONRY UNITS

- A. Burnished Concrete Block:
 - 1. Standard weight aggregate: ASTM C33.
 - 2. Lightweight aggregate conform to ASTM C331.
 - 3. Compressive Strength: ASTM C90 Type 1.
 - 4. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depths as indicated on the drawings. Hollow blocks.
 - 5. Special Shapes: Provide non-standard blocks configured for wall caps, sills, and corners, as indicated on drawings for specific locations.
 - a. Types: Provide sash blocks to accept rubber joint at control joints where indicated on plans.
 - 6. Color: As selected from manufacturer's standard range of colors.
 - a. Substitutions: See section 01 60 00 - Product Requirements.
 - 7. Manufacturer:
 - a. Texas Building Products, Strawn TX - color: Appaloosa.
 - b. Trenwyth Industries, Trendstone, Channahon, IL - color: Sundown.
 - c. Substitutions: See section 01 60 00 - Product Requirements.

2.03 BRICK UNITS

- A. Manufacturers:
 - 1. Endicott Clay Products Co; Rose Blend: www.endicott.com/#sle.
 - 2. Substitutions: See section 01 60 00 - Product Requirements.
- B. Facing Brick: 1, Type FBX, Grade SW.
 - 1. Texture: Match Existing Building.
 - 2. Actual size for 3/8 inch joint: Closure Modular - 3 5/8" x 3 5/8" x 7 5/8".

3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
 - a. Provide solid where holes would otherwise be exposed. Special shapes shall be of the same color range as the face brick, both field and accent units. Special shape units outside the face or accent brick color range will be rejected.
 - b. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
4. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm.) per minute when tested per ASTM C67.

2.04 MORTAR AND GROUT MATERIALS

- A. Mortar and Grout: As specified in Section 04 05 11.

2.05 REINFORCEMENT AND ANCHORAGE

- A. Manufacturers:
 1. Blok-Lok Limited: www.blok-lok.com/#sle.
 2. Hohmann & Barnard, Inc: www.h-b.com/sle.
 3. WIRE-BOND: www.wirebond.com/#sle.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Reinforcing Steel: Type specified in Section 03 20 00; size as indicated on drawings; uncoated finish.
- C. Single Wythe Joint Reinforcement: Truss type; ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M, Class B; 9 gauge 0.1483 inch (3.8 mm) side rods with 9 gauge 0.1483 inch (3.8 mm) cross rods; width as required to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage on each exposure.
 1. Provide prefabricated corner and intersection pieces at each corner, both outside and reentrant, for proper continuity.
- D. Wall Ties for Interior Veneer: Corrugated formed sheet metal, 7/8 inch (22 mm) wide by 22 gauge 0.03 inch (0.76 mm) thick, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not more than 1 inch (25 mm) and not less than 1 inch (25 mm) of mortar coverage from masonry face.

2.06 ACCESSORIES

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
 1. Manufacturers:
 - a. Blok-Lok Limited; RS Standard: www.blok-lok.com/#sle.
 - b. Hohmann & Barnard, Inc; RS Standard: www.h-b.com/sle.
 - c. WIRE-BOND; #2901: www.wirebond.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Joint Filler: Closed cell polyethylene; oversized 50 percent to joint width; self expanding; in maximum lengths available.
 1. Non-extruding, compatible with sealant used, resilient, rot, fungus insect and moisture resistant.
 2. For control joints in masonry, between masonry and structural members as well as other places indicated.
- C. Sand: Clean and dry for sand filled cores at sound deadening walls or where indicated. Stock pile and allow to thoroughly drain free water out so sand is free flowing when lifted on shovel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

- A. Lay out walls in advance for accurate spacing of vertical cores and for accurate location of openings, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Direct and coordinate placement of metal anchors, lintels, bolts, etc. supplied for installation under other sections.
- C. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.
- D. Build true to dimension, plumb, square, straight and in proper bond.
- E. Fill joints and brick holes full of mortar at top of exposed work.
- F. Step back coursing at end of work period for subsequent work. Do not tooth.
- G. Tooth new work into existing and previously laid work which has been built to vertical line.

3.03 COLD AND HOT WEATHER REQUIREMENTS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.
- C. Provide temporary tenting of masonry work area as required to meet project schedules.

3.04 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
 - 1. Match coursing at changes in direction.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Mortar Joints - Exterior: Concave.
 - 3. Mortar Joints - Interior: Concave at regular and burnished block.
- D. Brick Units:
 - 1. Bond: Running.
 - 2. Mortar Joints: Concave.

3.05 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, **with full head and bed joints**, uniformly jointed with other work.
 - 1. Joints that are not full will be rejected and walls will be taken down and rebuilt.
 - 2. All joints to be neatly tooled to a uniform depth with tool as work progresses.
 - 3. Rake floor joint of masonry without an applied base; at locations with brick or stone or burnished block at carpet or resilient floor.

4. Construct control and expansion joints with expansion filler, membranes and sealants as and where indicated.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Brick:
 1. Wet units down in hot weather when brick and mortar requires for proper suction.
- D. Block:
 1. Do not wet down units except where grout fill is required. Wet such cavities before filling to avoid sucking too much moisture out of grout.
 2. Lay heavy-weight units and fill voids with clean dry sand at walls noted on drawings for sound deadening walls. Fill cores as work progresses, maximum 48 inch (1219 mm) lifts.
- E. Buttering corners of joints or furrowing of mortar joints is not permitted.
- F. Remove excess mortar and mortar smears as work progresses.
- G. Interlock intersections and external corners unless shown otherwise, except for units laid in stack bond.
- H. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- I. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- J. Cut mortar joints flush where resilient base is scheduled.
- K. Isolate masonry partitions from vertical structural framing members with a control joint.
- L. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks as detailed on drawings.

3.06 PROJECT CONDITIONS

- A. 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.

3.07 REINFORCEMENT AND ANCHORAGE - GENERAL

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches (400 mm) on center.
- B. Lap joint reinforcement ends minimum 8 inches (203 mm).
 1. Provide prefabricated corner and intersections.
- C. Tie interior partitions to exterior walls with reinforcing. Allow reinforcing to project from constructed masonry if both wall and partition are not built simultaneously.
- D. Tie masonry to columns and beams with individual ties secured to concrete structure with dovetail units and to steel structure with self drilling and tapping screws or by welding. Clean welds and paint with zinc rich or cold galvanizing paint. Where concrete is not prepared for dovetail fasteners secure surface ties with drilled-in self tapping masonry screws. Install column ties in same course as reinforcing.
- E. Use surface ties when masonry will face or veneer structural members more than 16 inch (406 mm) high, existing masonry or concrete, sheathed framing and concrete without dovetail slots.

1. Surface tie fasteners shall provide a minimum pull-out strength of 100 pounds (45 kg) and prevent lateral movement of the tie except 160 pounds (72 kg) within 10 feet (3 m) of corners. Use corrosion resistant treated washer with fastener if needed to attain capacity.

3.08 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

- A. Install horizontal joint reinforcement 16 inches (400 mm) on center.
- B. Lap joint reinforcement ends minimum 8 inches (203 mm).

3.09 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

- A. Install horizontal joint reinforcement 16 inches (400 mm) on center.
- B. Lap joint reinforcement ends minimum 8 inches (203 mm).
- C. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches (400 mm) on center vertically and 32 inches (800 mm) on center horizontally. Stagger horizontal spacing 16 inch (400 mm) from previous course. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches (200 mm) on center.
- D. Stud Back-Up: Install gaskets manufactured to fit behind anchor plate or run continuous lengths of self-adhering self-sealing tape behind anchors. Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches (400 mm) on center vertically and 32 inches (800 mm) on center horizontally. Stagger horizontal spacing 16 inch (400 mm) from previous course. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches (200 mm) on center.
- E. Concrete or Steel Back-Up: Secure veneer anchors to back-up and embed into masonry veneer at maximum 16 inch (400 mm) on center vertically and 32 inch (800 mm) on center horizontally. Stagger horizontal spacing 16 inch (400 mm) from previous course. Place additional anchors at perimeter of openings and ends of panels and each side of control or expansion joints, so maximum spacing of anchors is 8 inch (200 mm) on center.

3.10 LINTELS

- A. Install loose steel lintels over openings.
 1. Exposed lintels shall be from structural steel only where shown on the Structural Drawings.
- B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
 1. Construct masonry block lintels from "U" shape bond blocks matching adjacent masonry block pattern and texture and color.
 2. Refer to structural Drawings for lintel type, size, reinforcing and details.
 3. Place and consolidate grout fill without displacing reinforcing.
 4. Allow masonry lintels to attain specified strength before removing temporary supports.
- C. Ledger Angles:
 1. Keep open or 'soft' joint under ledger at face brick so no direct bearing will occur.

3.11 GROUTED COMPONENTS

- A. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
- B. Place and consolidate grout fill without displacing reinforcing.
- C. Where cores are to be filled with grout, install mortar on webs to seal adjacent cores from grout. Keep bottom of cores clean of mortar so grout will contact concrete support

and/or grout. Mortar shall not project more than 1/2 inch (12.7 mm) from the face of the block in all block cores to be grouted.

- D. Fill cores with grout where fill is indicated. Place in maximum 48 inch (1219 mm) lifts. Stop lift 4 inch (100 mm) below top of unit except at top or under construction which caps over the core.
- E. Fill bond beams with grout not mortar.
- F. Cut out bottom of bond beam block unit at bearing to permit reinforcing and grout to continue through.
- G. Install grout in cores where anchors are shown. Place barrier at bottom of core section to be grouted unless required to be grouted for other reasons.
- H. Grout block cores solid under structural steel bearing unless other solid equivalent bearing is shown.
- I. Do not place any conduit or piping in grouted or reinforced vertical block cores or run piping or conduit horizontally through reinforced or vertical block cores unless specifically approved otherwise.
- J. Do not place any conduit or piping in horizontal bond beams unless specifically approved otherwise.

3.12 CONTROL AND EXPANSION JOINTS

- A. Install control joints in masonry walls every 24 lineal feet max. and wherever new wall bridges existing / new addition.
- B. Install control joints in masonry walls at every change in height of wall.
- C. Do not continue horizontal joint reinforcement through control or expansion joints.
- D. Construct control and expansion joints as and where shown.
- E. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- F. Form expansion joint as detailed on drawings.

3.13 BUILT-IN WORK

- A. As work progresses, install built-in metal door frames, window frames, anchor bolts, and plates and other items to be built into the work and furnished under other sections.
- B. Hollow metal frames: Grout hollow metal frame jamb and head sections at concrete and masonry. If door is set after masonry or concrete is in place, cut a port in the frame and grout frame in place with pourable cement grout or mortar mix; no salts permitted in grout.
- C. Install built-in items plumb, level, and true to line.
- D. Do not build into masonry construction organic materials that are subject to deterioration.

3.14 TOLERANCES

- A. Maximum Variation from Alignment of Columns: 1/4 inch (6 mm).
- B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.
- D. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.
- E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).

- F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).
- G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch (6 mm).

3.15 CUTTING AND FITTING

- A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.
 - 1. Do cutting and fitting for other trades.
- B. Cutting and fitting shall be neatly and accurately done with saw or drill.
- C. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.16 SPECIAL INSPECTION

- A. Reference Section 01 45 33 - Code-Required Special Inspections.

3.17 CLEANING

- A. In-Progress Cleaning: Remove excess mortar and mortar droppings from the face of masonry units at the end of each work day using stiff brushes.
- B. Final Cleaning: Clean in accordance with Technical Notes Nos. 20-64 and as outlined herein.
 - 1. Upon completion of masonry work and mortar is thoroughly set and cured, clean down exposed masonry surfaces.
 - 2. First dry clean. Remove particles of mortar using wood paddles and scrapers. Only use metal tools for very severe conditions. Then wet clean if necessary. Search joints for mortar-brick joint cracks showing potential moisture access. Rake out at least 1/2 inch (13 mm) deep and point all such conditions.
 - 3. Wet cleaning of brick shall be done by first flooding the surface with water to thoroughly soak and fill the pores with water. Then clean, using a dilute cleaner. Only when necessary may acid solution be used. Immediately and thoroughly rinse the cleaned surface. Repeat the second and third steps as often as necessary to clean the masonry. Clean small areas at a time to keep surfaces thoroughly wet.
 - 4. Commercial cleaners: **Follow instructions from graffiti control sealant manufacturer prior to applying any commercial cleaner.** Cleaner shall be used from new containers brought onto and stored on the site and shall be diluted and used in strict accordance with manufacturer's directions.
 - 5. Muriatic acid: **Follow instructions from graffiti control sealant manufacturer prior to applying any raw acid cleaner.** Muriatic acid may be used only when approved by manufacturer and if diluted at least 10:1 and when satisfactory tests have been performed to show that no damage shall result to the masonry.
- C. Hand Cleaning:
 - 1. If hand cleaning is done, apply the cleaning solution with fiber brushes, scrub the brick, not joints, and rinse thoroughly. The Owner may sample the cleaning solution and test for concentration of acids.
- D. Machine Cleaning:
 - 1. If an industrial cleaning machine is used, it shall have facility to provide heated water through hose and cleaning wand at controlled pressure to 1800 psi (12.4 MPa), and up to 250 degrees F (120 degrees C) at up to 5 gpm (19 l/m). Cleaning solution (acid or commercial cleaner) shall also be transported to the nozzle via a hose and disbursed into the water at approximately 2 gph (7.5 l/h). The spray wand or nozzle shall have separate water and cleaning solution valves. Personnel using such equipment shall have been trained in its use.

- E. Sealer: Seal exposed burnished block surfaces with graffiti repellant specified in section 07 19 00 Water Repellants.

3.18 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Structural steel framing members.
- B. Structural steel support members.
- C. Base plates, shear stud connectors.
- D. Grouting under base plates.

1.02 RELATED REQUIREMENTS

- A. Section 05 21 00 - Steel Joist Framing.
- B. Section 05 31 00 - Steel Decking: Support framing for small openings in deck.
- C. Section 05 50 00 - Metal Fabrications: Steel fabrications affecting structural steel work.
- D. Section 07 81 00 - Applied Fireproofing: Fireproof protection to framing and metal deck systems.

1.03 REFERENCE STANDARDS

- A. AISC (MAN) - Steel Construction Manual; 2011.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- D. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2013.
- E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- G. ASTM A449 - Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use; 2010.
- H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.
- I. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2007a (Reapproved 2014).
- J. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric]; 2007.
- K. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2011 (Reapproved 2015).
- L. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014.
- M. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2013.
- N. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.
- O. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2016.
- P. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2007a.

- Q. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- R. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- S. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2009.
- T. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).
- U. SSPC-SP 1 - Solvent Cleaning; 2015.
- V. SSPC-SP 3 - Power Tool Cleaning; 1982 (Ed. 2004).
- W. SSPC-SP 6 - Commercial Blast Cleaning; 2007.
- X. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, fasteners, and splices.
 - 2. Connections.
 - 3. Indicate cambers and loads.
 - 4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths, size and type. Indicate location of shop and field welds.
- C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
- D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."
- B. Comply with Section 10 of AISC S303 "Code of Standard Practice for Steel Buildings and Bridges" for architecturally exposed structural steel.
- C. Fabricator: Company specializing in performing the work of this section with minimum five years of experience.
- D. Erector: Company specializing in performing the work of this section with minimum five years of experience.
- E. Shop drawings shall be prepared under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Kansas.

1.06 REGULATORY REQUIREMENTS

- A. Conform to UL (FRD) Assembly Designs as indicated on the code plan.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Steel Angles, Plates, Channels, and Shapes: ASTM A36/A36M.
- B. Steel W Shapes and Tees: ASTM A992/A992M.
- C. Rolled Steel Structural Shapes: ASTM A992/A992M.
- D. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B $F_y = 46$ ksi.

- E. Pipe: ASTM A53/A53M, Grade B, Finish black and galvanized, as indicated.
- F. Shear Stud Connectors: Made from ASTM A 108 Grade 1015 bars or Grade 1020 bars.
- G. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436/F436M washers.
- H. Unheaded Anchor Rods: ASTM F1554, Grade 36, plain, with matching ASTM A563 or ASTM A563M nuts and ASTM F436/F436M Type 1 washers.
- I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- J. Grout: Non-shrink, non-metallic aggregate type, complying with 1 and capable of developing a minimum compressive strength of 7,000 psi (48 MPa) at 28 days.
 - 1. Noncorrosive, nonstaining grout.
- K. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.
 - 1. Lead-free, chromate-free, nonasphaltic, rust-inhibiting primer.
 - 2. At intumescent mastic fireproofing locations perform surface preparation and use primer which is approved by intumescent mastic fireproofing manufacturer.
- L. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type II - Organic, complying with VOC limitations of authorities having jurisdiction.
 - 1. Metallic zinc content, 95 percent by weight in dry film.
 - 2. Solids content, 52 percent by volume.
 - 3. Application rate, 1.5 mils dry film thickness per coat. Two coats required.
 - 4. Manufacturer:
 - a. ZRC Worldwide; ZRC Galviline Galvanizing Compound: www.zincrich.com.
 - b. Substitutions: See section 01 60 00 - Product requirements.

2.02 FABRICATION

- A. Shop fabricate to greatest extent possible.
- B. Use long lengths as possible.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
 - 1. Provide holes for attachment of finish materials, equipment, etc. where shown or where information is furnished prior to approval of shop drawings.
 - 2. Do not enlarge holes in members by burning or by the use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
- D. Splice members at locations shown on design drawings. Splices may be permitted elsewhere provided splices are shown on and approved on shop drawings.
- E. Attach concrete anchor lugs for composite designed members.
- F. Provide and install all miscellaneous anchor bolts, lag bolts, clips, etc. shown and required for structural steel and erection.
- G. Comply with AISC (MAN) Specifications for bearing, adequacy of temporary connections, alignment and the removal of paint on surfaces adjacent to field welds.
- H. Fabricate connections for bolt, nut, and washer connectors.
- I. Develop required camber for members.
- J. High-Strength Bolts: Shop install high-strength bolts according to RCSC (HSBOLT) "Specification for Structural Joints Using ASTM A325 or A 490 Bolts" for type of bolt and type of joint specified.
- K. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Use qualified welders.

2. Welds shall develop full strength of materials.
- L. Exposed Architectural Structural Steel: Exposed structural steel is defined as work left exposed to view in the completed building and within 25 feet (7.5 m) of normal viewing.
 1. Fabricate and erect in accordance with AISC (MAN) "Architecturally Exposed Structural Steel."
 2. All welds, where possible, shall be made in the shop.
 3. Grind smooth all exposed welds.
 4. Use body putty on non-continuous welds to form continuous smooth joint. Use body putty to fill or smooth areas where appearance is rough or not consistent.
 5. Finish exposed corners and edges comparable to formed and/or rolled flanged edges.
 6. Welds on flat surfaces shall be ground flush and smooth.
 7. Exposed grinding marks and body filler shall be indistinguishable from virgin metal when they can be viewed from in-place distance or 10 feet (3 m), whichever is less.
 8. No exposed bolted connections permitted, unless specifically indicated otherwise on drawings.
 9. Grind or sand smooth drips, runs and sags in the shop primer that are exposed to normally view and are objectionable to SJCF. Reapply primer as required for touch up.

2.03 FINISH

- A. Prepare structural component surfaces in accordance with SSPC-SP 3 for all interior exposed steel framing, unless noted otherwise.
- B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, surfaces to receive field installed headed stud shear connectors, in contact with concrete, high strength bolted, or slip critical connections.
 1. Apply primer at a rate to provide a minimum dry film thickness of 1.5 mils (0.04 mm).
 2. Runs, sags, etc. not permitted on exposed work.
 3. Provide paint for field connections and devices and marred or defective surfaces.
 4. Field touch-up - After installation, wire brush, clean, remove slag and paint scarred areas, welds and rust spots of primed or galvanized steel materials with primer or galvanizing repair paint, as appropriate, applied in accordance with paint manufacturer's instructions.
- C. Galvanize structural steel members; including exterior lintels and other members indicated on plans.
 1. ASTM A123/A123M for galvanizing iron and steel products.
 2. Completely fabricate members or assemblies prior to galvanizing. Provide air ports as needed in hollow members.
 3. Use a premixed liquid organic Galvilite zinc repair compound for regalvanizing shop or field welds or repairs in galvanized steel.

2.04 SOURCE QUALITY CONTROL

- A. Provide shop testing and analysis of structural steel.

High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".
- B. Welded Connections: Visually inspect all shop-welded connections and test all partial or complete penetration welds with Ultrasonic testing performed in accordance with ASTM E164. Perform continuous inspection of all fillet welds greater than 5/16 inch (8 mm). Perform visual inspection and bend testing of headed stud shear connectors in compliance with AWS D1.1/D1.1M, Section 7.

1. All testing of welds shall be performed prior to shop painting/galvanizing of the members.
2. Inspection reports shall be prepared and submitted on each member inspected; reports shall record the type and location of all defects identified and the procedure required and performed to correct the deficiencies
3. The visual inspection of all shop welding may be performed by the quality control inspector of an AISC Category STD certified fabrication plant.
4. An independent testing agency shall perform all ultrasonic inspections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

- A. Erect structural steel in compliance with AISC S303 "Code of Standard Practice for Steel Buildings and Bridges".
- B. Allow for erection loads, and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C. Field weld components indicated on shop drawings.
- D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".
- E. Do not field cut or alter structural members without approval of SJCF.
 1. Cutting will be permitted only on secondary members which are not under stress, as acceptable to SJCF. Finish gas-cut sections equal to a sheared appearance when permitted.
 2. Field installation of holes due to shop fabrication errors shall be made by field drilling only. Gas cutting of holes is not allowed. Notify SJCF of all required field modifications for direction prior to implementing modifications.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- G. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.
 1. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
 2. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
 3. Tighten the anchor bolts after the supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the base of bearing plate prior to packing with grout.
 4. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure in strict compliance with the manufacturer's instructions or as otherwise required.
 5. Wet cure the grout installation for a minimum of the first 24 hours after placement.

3.03 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

3.04 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".

- B. Welded Connections: Visually inspect all field-welded connections and test all partial or complete penetration welds with Ultrasonic testing performed in accordance with ASTM E164. Perform continuous inspection of all fillet welds greater than 5/16 inch (8 mm). Perform visual inspection and bend testing of headed stud shear connectors in compliance with AWS D1.1/D1.1M, Section 7.
1. Inspection reports shall be prepared and submitted on each member inspected; reports shall record the type and location of all defects identified and the procedure required and performed to correct the deficiencies.
 2. An independent testing agency shall perform all inspections.

END OF SECTION

SECTION 05 21 00 - STEEL JOIST FRAMING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Open web and long span steel joists , with bridging, attached seats and accessories.
- B. Special Joists: Steel joists or composite joists to be designed by the joist manufacturer for special loads and conditions indicated on the drawings.

1.02 RELATED REQUIREMENTS

- A. Section 05 12 00 - Structural Steel Framing: Grouting base plates and bearing plates. Superstructure framing.
- B. Section 05 31 00 - Steel Decking: Bearing plates and angles.
- C. Section 07 81 00 - Applied Fireproofing: Fireproof protection of joist framing and metal deck systems.

1.03 REFERENCE STANDARDS

- A. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2013.
- B. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014.
- C. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- D. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2009.
- E. SJI (SPEC) - Catalog of Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders; 2011.
- F. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders; 2008.
- G. SSPC-SP 3 - Power Tool Cleaning; 1982 (Ed. 2004).
- H. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.
- C. Welders' Certificates: Submit manufacturer's certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with 1 Standard Specifications Load Tables and 2 and SJI (SPEC) Standard Specification for composite steel joists.
- B. Design and Installation Requirements: Conform to 1 Assembly Design No. as indicated on the code plan.
- C. Manufacturer Qualifications: Company specializing in performing the work of this section with minimum five years experience.
- D. Manufacturers Responsibilities: Design of special joists under direct supervision of a professional structural engineer experienced in design of this work and licensed in the state of Kansas.
- E. Member of Steel Joist Institute.

- F. Erector Qualifications: Company specializing in performing the work of this section with minimum five years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Transport, handle, store, and protect products to SJI requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Steel Joists:
1. Canam Group Inc: www.canam-steeljoists.ws
 2. Nucor-Vulcraft Group: www.vulcraft.com/#sle.
 3. New Millennium Building Systems: www.newmill.com.
 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

- A. Open Web Joists: Types as indicated on drawings:
1. Fabricate joists for special end depth, slope and bearing length and conditions as shown on the Structural Drawings.
 2. Provide bottom and top chord extensions as indicated.
 3. Design joist for additional special loading conditions where indicated on the drawings. The joist shall be designed for the indicated special loads in addition to the standard SJI (SPEC) Standard Specification Load Tables.
 - a. Composite joists shall be designed for the indicated special loads in addition to the standard loads indicated on the structural drawings, unless otherwise indicated.
 4. Design web members of joists to accommodate ducts running perpendicular to joists to the extent that web configuration would interfere. Joist manufacturer to show locations on shop drawings.
 5. Finish: Shop primed.
- B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- C. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI (SPEC) for type of joist, chord size, spacing, and span. Refer to the Structural Drawings for special bridging and bracing requirements.
1. Furnish additional erection bridging if required for stability
 2. Provide horizontal bridging, top and bottoms chords, when equipment or ducts are running parallel to or between joists to the extent that diagonal bracing would interfere. Joist manufacturer to show locations on shop drawings.

2.03 FINISH

- A. Shop prime joists .
1. Do not prime surfaces that will be fireproofed or top surface of joist top chord which will receive field installed headed stud shear connectors.
- B. Prepare surfaces to be finished in accordance with SSPC-SP 3.
- 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 (.025 mm) thick.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions prior to beginning work.

3.02 ERECTION

- A. Erect joists with correct bearing on supports.
- B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.
- C. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.
- D. Provide bolted connections for joist bearing at column centerlines per SJI "Specifications."
- E. Position and field weld joist chord extensions and wall attachments as detailed.
- F. Do not permit erection of decking until joists are braced and secured or until completion of erection and installation of permanent bridging and bracing.
- G. Do not field cut or alter structural members without approval of joist manufacturer.
- H. Joists exposed to view in the completed structure shall have members which are straight and true with connections neatly detailed and fabricated.
- I. After erection, prime welds, damaged shop primer, and surfaces not shop primed, except surfaces specified not to be primed.

3.03 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm).
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

3.04 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with 1 "Specification for Structural Joints Using High-Strength Bolts".
- C. Welded Connections: Visually inspect all field-welded connections and test all partial or complete penetration welds using the following:
 - 1. Ultrasonic testing performed in accordance with ASTM E164.

END OF SECTION

SECTION 05 31 00 - STEEL DECKING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Roof deck.
- B. Composite floor deck.

1.02 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- B. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- C. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2008.
- D. ICC-ES AC70 - Acceptance Criteria for Fasteners Power Driven into Concrete, Steel and Masonry Elements; ICC Evaluation Service, Inc; 2013.
- E. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.
- F. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).
- G. UL (FRD) - Fire Resistance Directory; current edition.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.
- B. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.
 - 1. Indicate sheet quantities and lengths.
 - 2. Indicate anchorage of each type of deck and location.
 - a. Use of power-actuated mechanical fasteners must be approved by the Structural Engineer prior to installation of decking. Submit type of gun, fastener and installers training certifications.
- C. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
- D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this Section with minimum five years of documented experience.
- B. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Cut plastic wrap to encourage ventilation.
- B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Steel Deck:

1. Canam Steel Corporation: www.canam-steeljoists.ws.
2. Cordeck, Inc: www.cordeck.com/#sle.
3. Nucor-Vulcraft Group: www.vulcraft.com/#sle.
4. New Millenium Building Systems: www.newmill.com.
5. Epic Metals Corporation: www.epicmetals.com.
6. Consolidated Systems Inc. - Metal Dek Group: www.metaldek.com.
7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 STEEL DECK

- A. All Deck Types: Select and design metal deck in accordance with SDI Design Manual.
- B. Steel decking as noted on structural drawings.
- C. Deck gage thickness shall be not less than that from which manufacturer's moment of inertia was computed (exclusive of coatings) nor less than gage and moment of inertia required by structural drawings.
- D. Roof Deck: Non-composite type, fluted steel sheet:
 1. Galvanized Steel Sheet: 1, Structural Steel (SS), with G60/Z180 galvanized coating.
- E. Composite Floor Deck: Fluted steel sheet embossed to interlock with concrete:
 1. Galvanized Steel Sheet: 1, Structural Steel (SS), with G60/Z180 galvanized coating.

2.03 ACCESSORY MATERIALS

- A. Welding Materials: AWS D1.1/D1.1M.
- B. Fasteners: Galvanized hardened steel, self tapping.
- C. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.
- D. Flute Closures: Closed cell foam rubber, 1 inch (25 mm) thick; profiled to fit tight to the deck.
- E. Hanger Slots or Clips: Provide UL (DIR) approved punched hanger slots between cells or flutes of lower element where floor deck units are to receive hangers for support of ceiling construction, air ducts, diffusers, or lighting fixtures.
 1. Hangers which clip over male side lap joints of floor deck units may be used instead of hanger slots.
 2. Locate slots or clips at not more than 14 inch (355 mm) o.c. in both directions, not over 9 inch (228 mm) from walls at ends, and not more than 12 inch (305 mm) from walls at sides, unless otherwise shown.
 3. Provide manufacturer's standard hanger attachment devices.

2.04 FABRICATED DECK ACCESSORIES

- A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 22 gage, 0.0299 inch (0.76 mm) thick sheet steel; of profile and size as indicated; finished same as deck.
- B. Roof Sump Pans: Formed sheet steel, 14 gage, 0.0747 inch (1.90 mm) minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches (38 mm) below roof deck surface, bearing flange 3 inches (75 mm) wide, sealed watertight, with G60/Z180 galvanized coating.
- C. Floor Drain Pans: 14 gage, 0.0747 inch (1.90 mm) sheet steel, flat bottom, sloped sides, recessed 1-1/2 inches (38 mm) below floor deck surface, bearing flange 3 inches (75 mm) wide, sealed watertight, with G60/Z180 galvanized coating.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify existing conditions prior to beginning work.

3.02 INSTALLATION

- A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.
- B. On concrete and masonry surfaces provide minimum 4 inch (100 mm) bearing.
- C. On steel supports provide minimum 1-1/2 inch (38 mm) bearing.
- D. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.
- E. Place deck units in straight alignment for entire length of run. Closely align ribs or cells at ends of abutting units.
- F. Coordinate locating decking bundles to prevent overloading of structural members.
- G. Fasten deck to support members as indicated on structural drawings.
- H. Do not use deck units for storage or working platforms until permanently secured and lap fasteners installed.
- I. Where deck (other than cellular deck electrical raceway) changes direction, install 6 inch (150 mm) minimum wide sheet steel cover plates, of same thickness as deck. Fusion weld 12 inches (300 mm) on center maximum.
- J. Cut neatly and accurately, with power shears, saw or other approved method so not to burn back finish.
- K. At floor edges, install concrete stops upturned to top surface of slab, to contain wet concrete. Provide stops of sufficient strength to remain stationary without distortion.
- L. Reinforce openings as shown on structural drawings and approved shop drawings, no opening exceeding 9 inch (228 mm) in width parallel to the structural framing members shall be cut in the deck unless shown on the structural drawings or approved by SJCF.
- M. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.
- N. Close openings above walls and partitions perpendicular to deck flutes with double row of foam cell closures. Install with adhesive in accordance with manufacturer's instructions. Delete foam cell closure at fire rated partitions, refer to details for fire rated condition.
- O. Position roof drain pans with flange bearing on top surface of deck. Mechanically attach at each deck flute.
- P. Position floor drain pans with flange bearing on top surface of deck. Mechanically attach at each deck flute.
- Q. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

3.03 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - QUALITY REQUIREMENTS.
- B. Provide visual inspection of the metal floor deck and roof deck mechanical fastener or field weld installation.

1. Inspection reports shall be prepared and submitted on each area inspected; reports shall record the type and location of all defects identified and the procedure required and performed to correct the deficiencies.

END OF SECTION

SECTION 05 40 00 - COLD-FORMED METAL FRAMING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Formed steel stud exterior wall framing at metal panel clad walls and interior wall framing with brick veneer.
- B. Formed steel misc. framing and bridging at feature locations.

1.02 RELATED REQUIREMENTS

- A. Section 05 31 00 - Steel Decking.
- B. Section 06 10 00 - Rough Carpentry: Wood blocking and miscellaneous framing.
- C. Section 07 21 00 - Thermal Insulation: Insulation within framing members.
- D. Section 07 25 00 - Weather Barriers: Weather barrier over sheathing.
- E. Section 07 92 00 - Joint Sealants.

1.03 REFERENCE STANDARDS

- A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- D. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2011c.
- E. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2011a.
- F. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.
- G. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- H. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2008.
- I. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.
- C. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
 - 1. Include all installation requirements not fully dimensioned or detailed in manufacturer's product data.

2. Submittal must indicate all fastener requirements for framing member to member connections and member to adjacent construction connections. The fastener type, size, spacing and location required to properly complete the cold-framed metal framing system must be clearly indicated.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years experience and approved by manufacturer.
- C. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI's "Code of Standard Practice".

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Framing:
 1. CEMCO: www.cemcosteel.com/#sle.
 2. ClarkDietrich Building Systems: www.clarkdietrich.com.
 3. Marino: www.marinoware.com/#sle.
 4. The Steel Network, Inc: www.SteelNetwork.com/#sle.
 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Framing Connectors and Accessories:
 1. Same manufacturer as metal framing, u.n.o.
 2. Simpson Strong Tie: www.strongtie.com.
 3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FRAMING SYSTEM

- A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

2.03 FRAMING MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as indicated below.
- B. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
 1. Grade: Minimum yield strength of 33 ksi (230 MPa) for 18 gage and lighter. Minimum yield strength of 50 ksi (340 MPa) for 16 gage and heavier.
 2. Gage and Depth: As indicated on drawings.
 3. Galvanized in accordance with ASTM A653/A653M, G60/Z180 coating.
- C. Joists and Purlins: Fabricated from ASTM A653/A653M steel sheet, with G60/Z180 hot dipped galvanized coating.
 1. Grade: Minimum yield strength of 33 k.s.i. (230 MPa) for 18 guage and lighter. Minimum yield strength of 50 ksi (340 MPa) for 16 gage and heavier.
 2. Gage and Depth: As indicated on drawings.

- D. Framing Connectors: Factory-made, formed steel sheet.
1. Material: ASTM A1003/A1003M, ASTM A653/A653M SS Grade 50 (340), with G90/Z275 hot dipped galvanized coating for base metal thickness less than 10 gage, 0.1345 inch (3.42 mm), and factory punched holes and slots.
 2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
 3. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.
 - a. Where continuous studs bypass elevated floor slab, connect stud to slab in manner allowing vertical movement of slab without affecting studs; allow for minimum movement of 1/2 inch (13 mm).
 - b. Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical movement of slab without affecting studs; allow for minimum movement of 1/2 inch (13 mm) at wall beams, floor beams and floor joist and 1 1/2 inch (39 mm) at roof joist.
 - c. Provide top track with long leg track and head of wall movement connectors; minimum track length of 10 feet (3048 mm).
 - d. Acceptable Products:
 - 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. Install a continuous row of bridging, composed of 1 1/2 inch (38 mm) cold-formed channel secured to each stud with clip angle, at upper-most knockout, not more than 12 inch (305 mm) from top of wall.
 - 2) Slotted Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; punched with vertical slots in both legs. Studs should be positively attached to deep-leg track using vertical slots while allowing free vertical movement. Legs designed to support horizontal and lateral loads and transfer them to the primary structure.
 4. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.
 5. Wall Stud Bridging Connections: Provide mechanical load-transferring devices that accommodate wind load torsion and weak axis buckling induced by axial compression loads. Provide bridging connections where indicated on the drawings.

2.04 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
- B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.
- C. Water-Resistive Barrier: As specified in Section 07 25 00.

2.05 FASTENERS

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
 2. Wire tying of framing components is not permitted.

- B. Anchorage Devices: Powder actuated and Drilled expansion bolts.
- C. Welding: In conformance with AWS D1.3/D1.3M.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that building framing components are ready to receive work.
- B. Verify field measurements and adjust installation as required.

3.02 GENERAL

- A. Framing components may be prefabricated into panels prior to erection. Fabricate panels, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated panels in a manner to prevent danger or distortion.
- B. Panels prefabricated in jig templates to hold members in proper alignment and position and to assure consistent component placement.

3.03 INSTALLATION OF STUDS

- A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.
- B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches (600 mm) on center. Provide fasteners at corners and ends of track. Track sections shall be sized to match the size and gage of the wall studs.
- C. Place studs at 16 inches (400 mm) on center or as indicated on drawings; not more than 2 inches (50 mm) from abutting walls and at each side of openings. Connect studs to tracks using fastener or welding method.
- D. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
 - 1. 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.
- E. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs. Provide lintel framing as indicated. Reference structural drawings for additional requirements.
- F. Install load bearing studs full length in one piece. Splicing of studs is not permitted.
- G. Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.
 - 1. Install horizontal stiffeners (bridging) in stud system at exterior walls, spaced at not more than 4 feet (1 m) o.c. vertically. Weld or screw fasten at each intersection.
- H. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure.
- I. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
- J. Install intermediate studs above and below openings to align with wall stud spacing.
- K. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.
- L. Attach cross studs to studs for attachment of fixtures anchored to walls.

- M. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- N. Install supplementary framing, blocking and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim, base trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations in each case, considering weight and loading resulting from item supported.
- O. Frame both sides of expansion joints, with separate studs; do not bridge the joint with components of stud system.
- P. Touch-up field welds and damaged galvanized surfaces with primer.

3.04 TOLERANCES

- A. Maximum Variation from True Position: 1/8 inch (3 mm).
- B. Maximum Variation of any Member from Plane: 1/8 inch (3 mm).
- C. Maximum Variation of fabricated panels in alignment: 1/16 inch (1.5 mm).

END OF SECTION

SECTION 05 50 00 - METAL FABRICATIONS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Shop fabricated steel and aluminum items.
- B. Includes metal items required under other divisions such as anchors, bolts, sleeves, lintels, brackets except where specification states that item(s) are to be furnished to the Contractor for installation.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 05 52 13 - Pipe and Tube Railings.
- C. Section 09 91 13 - Exterior Painting: Paint finish.
- D. Section 09 91 23 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2011 (Reapproved 2015).
- B. SSPC-SP 3 - Power Tool Cleaning; 1982 (Ed. 2004).
- C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.
- D. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008.
- E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- H. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- I. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.
- J. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.
- K. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.
- L. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- M. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.
- N. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2012.
- O. ASTM B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric); 2012.
- P. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2012.

- Q. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric); 2012.
- R. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- S. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.
- T. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.
- U. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- V. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- W. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2008.
- X. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).
- Y. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A 36/A 36M, u.n.o.
- B. Steel W Shapes and Tees: ASTM A992/A992M.
- C. Steel Tubing: ASTM A500/A500M, Grade B cold-formed structural tubing.
- D. Plates: ASTM A283/A283M.
- E. Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.
- F. Fasteners: Provide stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5 at exterior walls. Select fasteners for type, grade and class required.
- G. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, galvanized to ASTM A153/A153M where connecting galvanized components.
- H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- I. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 MATERIALS - ALUMINUM

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5052 alloy, H32 or H22 temper.

- C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210 (ASTM B210M), 6063 alloy, T6 temper.
- D. Aluminum-Alloy Bars: ASTM B211 (ASTM B211M), 6061 alloy, T6 temper.
- E. Bolts, Nuts, and Washers: Stainless steel.
- F. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.03 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs, sharp edges or rough areas on exposed surfaces.
- D. Continuously seal joined members by continuous welds.
- E. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- F. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- I. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED ITEMS

- A. Ledge Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking and joists; prime paint finish interior, galvanize finish at exterior wall.
 - 1. Provide shelf angles as sized and shown on drawings with anchor devices. Install as masonry work progresses. Keep minimum 1/4 inch (6.3 mm) gap between members. After mason places compressible filler install angle on filler, securing fasteners and not compressing filler.
- B. Lintels: As detailed; prime paint finish interior, galvanize finish at exterior wall.
 - 1. Provide steel lintels for masonry openings except where pre-cast concrete or reinforced masonry lintels are shown.
 - 2. Steel shapes or plate lintels for all miscellaneous openings in masonry over such items as ducts, doors, recessed equipment, etc. Consult drawings for extent of such openings and lintels.
- C. Anchor Devices: Inserts and anchoring devices for all metal work this section. Anchors, tie bolts, inserts, hangers etc. to anchor and support other construction to concrete, masonry or steel.

2.05 FINISHES - STEEL

- A. Prime paint steel items.
 - 1. Exceptions: Galvanize items to be embedded in concrete, items to be embedded in masonry, and items specified for galvanize finish.
 - 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP 3.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

- D. Prime Painting: One coat.
- E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements.
- F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.06 FINISHES - ALUMINUM

- A. Interior Aluminum Surfaces: Class I natural anodized.
- B. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.
- C. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.07 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).
- C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).
- D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
- E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components as indicated on drawings.
- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
- C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

SECTION 05 52 13 - PIPE AND TUBE RAILINGS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Wall mounted handrails.
- B. Stair railings and guardrails.
- C. Free-standing railings at steps.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Placement of anchors in concrete.

1.03 REFERENCE STANDARDS

- A. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.
- B. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2014.
- C. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2015b.
- D. ASTM A312/A312M - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes; 2015.
- E. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel; 2013.
- F. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing; 2015.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- H. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- I. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014.
- J. ASTM F1267 - Standard Specification for Metal, Expanded, Steel; 2015.
- K. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- L. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- M. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.
- N. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.
- O. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2013.
- P. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2000 (Reapproved 2006).
- Q. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

PART 2 PRODUCTS**2.01 RAILINGS - GENERAL REQUIREMENTS**

- A. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq ft (0.093 sq m).
 - b. Infill load and other loads need not be assumed to act concurrently.
- B. Allow for expansion and contraction of members and building movement without damage to connections or members.
- C. Dimensions: See drawings for configurations and heights.
- D. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
 - 1. For anchorage to concrete, provide inserts to be cast into concrete, for welding anchors.
 - 2. Posts: Provide adjustable flanged brackets.
- E. Provide mechanical and welding fittings where indicated to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.
- F. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- G. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.02 STAINLESS STEEL MATERIALS

- A. Tubing: ASTM A554, Grade MT 316L.
- B. Pipe: ASTM A312/A312M, Grade TP 316L.
- C. Plate and Sheet: ASTM A240/A240M or ASTM A666, Grade 316L.

2.03 FABRICATION

- A. Accurately form components to suit specific project conditions and for proper connection to building structure.
- B. Fit and shop assemble components in largest practical sizes for delivery to site.
- C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
- D. Cut, drill, and punch metals cleanly and accurately. Remove burrs and sharp or rough areas on exposed surfaces.
- E. Form work true to line and level with accurate angles and surfaces.

- F. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- G. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- H. Welded Joints:
 - 1. Exterior Components: Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
 - 2. Interior Components: Continuously seal joined pieces by continuous welds.
 - 3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- I. Close exposed ends of railing members.
- J. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.
- K. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

2.04 STAINLESS STEEL FINISHES

- A. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
 - 1. Directional Satin Finish: No. 4.
- B. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Supply items required to be cast into concrete with setting templates, for installation as work of other sections.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- C. Install railings in compliance with ADA Standards for accessible design at applicable locations.
- D. Anchor railings securely to structure.
- E. Field weld anchors as indicated on drawings. Touch-up welds with primer. Grind welds smooth.
- F. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
- G. Attach handrails to post with mounts as shown on drawings. Provide 1 1/2" inch clearance from inside face of handrail with post. Locate brackets at a maximum spacing of 48 inches.
- H. For railing posts set in concrete, form or core-drill holes not less than 6 inch (150 mm) deep and 3/4 inch (20 mm) larger than outside diameter. Clean holes of loose material,

insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout.

1. Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per floor level, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
- C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

SECTION 06 10 00 - ROUGH CARPENTRY**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Sheathing.
- B. Roof-mounted curbs.
- C. Roofing nailers.
- D. Preservative treated wood materials.
- E. Fire retardant treated wood materials.
- F. Miscellaneous framing and sheathing.
- G. Communications and electrical room mounting boards.
- H. Concealed wood blocking, nailers, and supports.
- I. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

- A. Section 05 12 00 - Structural Steel Framing: Prefabricated beams and columns for support of wood framing.
- B. Section 05 50 00 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.
- C. Section 07 25 00 - Weather Barriers: Air barrier over sheathing.
- D. Section 07 25 00 - Weather Barriers: Water-resistive barrier over sheathing.

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 2009.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- D. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.
- E. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010.
- F. ASME B18.2.1 - Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series); 2010.
- G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.
- H. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2007a (Reapproved 2014).
- I. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric]; 2007.
- J. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- K. ASTM C1325 - Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units; 2014.
- L. ASTM D2559 - Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions; 2012a.

- M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- N. AWPA U1 - Use Category System: User Specification for Treated Wood; 2012.
- O. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples; 2013.
- P. PS 1 - Structural Plywood; 2009.
- Q. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; 2010.
- R. PS 20 - American Softwood Lumber Standard; 2010.
- S. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber; 2000.
- T. SPIB (GR) - Grading Rules; 2014.
- U. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17; 2004, and supplements.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on chemical treatments as indicated below.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
 - 2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
 - a. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.

2.02 DIMENSION LUMBER

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry or MC19.
- C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

- A. Wall Sheathing: Applied to exterior studs as a backup to metal composite and metal panels and where indicated on the drawings: Glass mat faced gypsum, ASTM C1177/C1177M, 5/8 inch Type X fire resistant (16 mm Type X fire resistant).
 - 1. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly.
 - 2. Edges: Square.
 - 3. Glass Mat Faced Products:
 - a. Georgia-Pacific Gypsum; DensGlass Sheathing: www.gpgypsum.com.
 - b. USG Corporation; Securock Glass Mat Sheathing Panels: www.usg.com.
 - c. National Gypsum Company; Gold Bond e(2)XP: www.nationalgypsum.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- C. Other Applications:
 - 1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
 - 2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
 - 3. Other Locations: PS 1, C-D Plugged or better.

2.04 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M or Type 304 stainless steel for high humidity locations, preservative-treated wood locations and fire-retardant treated wood locations, unfinished steel elsewhere.
 - 2. Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.
 - a. Sustain a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete.
 - 3. Nails, Brads, and Staples: ASTM F1667.
 - 4. Power-Driven Fasteners: NES NER-272.
 - 5. Wood Screws: ASME B18.6.1.
 - 6. Lag Bolts: ASME B18.2.1.
 - 7. Bolts: Steel bolts complying with ASTM A307, Grade A (ASTM F568M, Property Class 4.6); with ASTM A563 (ASTM A563M) hex nuts and, where indicated, flat washers.
- B. Die-Stamped Connectors: ASTM A653/A653M, G60 hot dipped galvanized steel interior, ASTM A666 Stainless-Steel exterior, sized to suit framing conditions.
 - 1. For contact with preservative treated wood in exposed locations, provide minimum G185 (Z550) galvanizing complying with ASTM A653/A653M.
- C. Sill Gasket on Top of Foundation Wall: 1/4 inch (6 mm) thick, plate width, closed cell plastic foam from continuous rolls.
- D. Sill Flashing: As specified in Section 07 62 00.
- E. Water-Resistive Barrier: As specified in Section 07 25 00.

2.05 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWP A U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
 2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWP standards.
- B. Fire Retardant Treatment:
1. Exterior Type: AWP U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Use treatment that does not promote corrosion of metal fasteners.
 - c. Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898.
 - d. Treat all exterior rough carpentry items as indicated.
 - e. Do not use treated wood in direct contact with the ground.
 2. Interior Type A: AWP U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Use treatment that does not promote corrosion of metal fasteners.
 - c. Interior fire retardant treated lumber and plywood shall have equilibrium moisture content of not over 28% when tested in accordance with ASTM D3201 at 92% relative humidity.
 - d. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D5664 and design value adjustment factors shall be calculated according to ASTM D6841.
 - e. Treat rough carpentry items as indicated .
 - f. Do not use treated wood in applications exposed to weather or where the wood may become wet.
- C. Preservative Treatment:
1. Preservative Pressure Treatment of Lumber Above Grade: AWP U1, Use Category UC3B exterior use, Category UC2 interior use, Commodity Specification A using waterborne preservative containing no arsenic or chromium . For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not affect finishes.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - 1) Do not use material that is warped or that does not comply with requirements for untreated material.
 - b. Treat lumber exposed to weather.
 - c. Treat lumber in contact with roofing or flashing including but not limited to roof edge, nailers, curbs, equipment support bases and blocking.
 - d. Treat lumber concealed in and in contact with masonry or concrete including but not limited to nailers and blocking.

- e. Treat lumber less than 18 inches (450 mm) above grade in crawlspaces or unexcavated areas.
- f. Treat lumber applied to exterior walls.
- g. Treat lumber in contact with concrete slab on grade.
- h. Treat lumber in other locations as indicated.
- 2. Preservative Pressure Treatment of Plywood Above Grade: AWP A U1, Use Category UC2 interior use and UC3B exterior use, Commodity Specification F using waterborne preservative containing no arsenic or chromium . For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not affect finishes.
 - a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
 - 1) Do not use material that is warped or that does not comply with requirements for untreated material.
 - b. Treat plywood in contact with roofing or flashing including but not limited to roof edge, nailers, curbs, equipment support bases and blocking.
 - c. Treat plywood in contact with masonry or concrete including but not limited to nailers and blocking.
 - d. Treat plywood less than 18 inches (450 mm) above grade in crawlspaces or unexcavated areas.
 - e. Treat plywood in other locations as indicated.
- 3. Preservative Pressure Treatment of Lumber in Contact with Soil: AWP A U1, Use Category UC4A exterior use, Commodity Specification A using waterborne preservative .
 - a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.
 - b. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

PART 3 EXECUTION

3.01 PREPARATION

- A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches (100 mm) and seal.
- B. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.
- C. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- C. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- D. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.
- E. Fit carpentry to other construction; scribe and cope as required for accurate fit.
- F. Countersink nail heads on exposed carpentry work and fill holes with wood filler.
- G. Predrill members for fasteners when necessary to avoid splitting wood.

- H. Countersink bolt heads, nuts and washers where required. Countersink only depth needed to bring bolt head or nut flush with face of lumber maintaining as much of the secured member wood under anchorage as possible.

3.03 PRESERVATIVE-TREATED WOOD - GENERAL

- A. Where wood-preserved-treated lumber is installed adjacent to metal decking, metal flashings or other metal products, install continuous flexible flashing separator, such as a peel-and-stick polymeric membrane, between treated wood and metal.

3.04 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
 - 1. Blocking is not required to be treated, unless in contact with concrete slab on grade.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
- C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of wood frames and/or trim, securely attached to stud framing.
- D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

3.05 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Secure blocking to metal decking by bolting into supporting structure or through decking into supplemental blocking.

3.06 INSTALLATION OF CONSTRUCTION PANELS

- A. Wall Sheathing, Glass mat faced gypsum: Secure with long dimension perpendicular to wall studs, with ends over firm bearing, using rust-resistant, bugle or wafer head, coarse thread, 1 1/4 inch (31 mm) length wood fasteners unless otherwise indicated. Attach with screws spaced 8 inches (203 mm) on center at perimeter where there are framing supports and 8 inches (203 mm) on center along intermediate framing in the field.
- B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
 - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 - 3. Install adjacent boards without gaps.
 - 4. Size and Location: As indicated on drawings.

3.07 SITE APPLIED WOOD TREATMENT

- A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.
- B. Allow preservative to dry prior to erecting members.

3.08 FIRE RETARDANT TREATED PLYWOOD

- A. Lumber: Do not rip or mill fire retardant treated lumber. Cross cuts, joining cuts, and drilling holes are permitted.
- B. Plywood: Fire retardant treated plywood may be cut in any direction.

3.09 TOLERANCES

- A. Framing Members: 1/4 inch (6 mm) from true position, maximum.
- B. Surface Flatness of Floor: 1/8 inch in 10 feet (1 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.
- C. Variation from Plane (Other than Floors): 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

3.10 CLEANING

- A. Waste Disposal: Comply with the requirements of Section 01 74 19 - Construction Waste Management and Disposal.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not burn scraps that have been pressure treated.
 - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 41 00 - ARCHITECTURAL WOOD CASEWORK**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Specially fabricated cabinet units.
- B. Cabinet hardware.
- C. Preparation for site finishing.
- D. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 08 80 00 - Glazing: Glass for casework.
- C. Section 09 91 23 - Interior Painting: Site finishing of cabinet exterior.
- D. Section 12 36 00 - Countertops.

1.03 REFERENCE STANDARDS

- A. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- C. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.
- D. BHMA A156.18 - American National Standard for Materials and Finishes; 2012.
- E. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.
- F. GSA CID A-A-1936 - Adhesive, Contact, Neoprene Rubber; Revision A, 1996.
- G. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2009.
- H. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- I. PS 1 - Structural Plywood; 2009.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
 - 2. Provide the information required by AWI/AWMAC/WI (AWS).
 - 3. Show locations and sizes of concealed blocking specified in other Sections.
 - 4. Show locations for plumbing fixtures and other items installed in Architectural Wood Casework.
- C. Product Data: Provide data for hardware accessories.
- D. Samples For Initial Selection: Samples for initial selection purposes of the following in form of manufacturer's color charts consisting of actual units or sections of units showing full range of colors, textures, and patterns available for each type of material indicated.
 - 1. Plastic laminate
 - 2. PVC edge banding
 - 3. Cabinet liner material

- E. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates, including the QCP project registration number.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of experience.
 - 1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- B. Installer Qualifications: Company specializing in installation of the products specified in this section with minimum three years of experience.
- C. Quality Certification:
 - 1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section.
 - 2. **Provide AWI Quality Certification Program Certificates** indicating that the woodwork, not including installation, complies with requirements of grades specified. The Architectural Wood Casework Contractor, upon award of work, shall register the work under this section with the AWI Quality Certification Program (800-449-8811). Cost to be included.
 - 3. Provide designated labels on shop drawings as required by certification program.
 - 4. Provide designated labels on installed products as required by certification program.
 - 5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
 - 6. Replace, repair, or rework all work for which certification is refused.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.
- B. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.
- C. Do not deliver woodwork until painting, wet work, grinding, and similar operations have been completed in installation areas.

1.08 FIELD CONDITIONS

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.
 - 1. Building shall be enclosed, wet work shall be complete, and HVAC system shall be operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.
 - 1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with manufacture of woodwork without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

PART 2 PRODUCTS

2.01 CABINETS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
- B. Plastic Laminate Cabinets:

1. Exposed Surfaces:
 - a. Horizontal Surfaces Other Than Tops: Grade HGS.
 - b. Vertical Surfaces: Grade VGS.
 - c. Edges: PVC edge banding
2. Semi-exposed Surfaces:
 - a. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
 - b. Edges: PVC edge banding
 - 1) All edges, including adjustable shelves, shall have PVC edge banding on all sides.
 - c. For semi-exposed backs of panels, including back side of doors, with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.
 - d. For tops of upper cabinets and tall storage units: Thermoset decorative panels.
 - e. For bottom side of upper cabinets: High-pressure decorative laminate, Grade VGS.
 - f. Drawer Sides and Backs: Thermoset decorative panels.
 - g. Drawer Bottoms: Thermoset decorative panels.
3. Cabinet Style: Flush overlay.
4. Cabinet Doors and Drawer Fronts: Flush style.
5. Provide dust panels of 1/4 inch (6.4 mm) tempered hardboard above compartments and drawers, unless located directly under tops.

2.02 WOOD-BASED COMPONENTS

- A. Wood fabricated from old growth timber is not permitted.
- B. General: Provide materials that comply with requirements of AWI/AWMAC/WI (AWS) for each type of woodwork and quality grade specified, unless otherwise indicated.
- C. Particleboard: ANSI A208.1; medium density industrial type as specified in AWI/AWMAC/WI (AWS), composed of wood chips bonded with interior grade adhesive under heat and pressure; sanded faces; Grade M-2; thickness as indicated.
 1. Use for concealed components.
 2. Use as backing for plastic laminate unless otherwise indicated.
- D. Medium Density Fiberboard (MDF): ANSI A208.2; type as specified in AWI/AWMAC/WI (AWS); composed of wood fibers pressure bonded with interior grade adhesive to suit application; sanded faces; Grade MD; thickness as indicated.
 1. Use for concealed components.
 2. Use as backing for plastic laminate unless otherwise indicated.
- E. Softwood Plywood: PS 1, thickness as indicated, use where indicated.
- F. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
- G. Hardboard: AHA A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch (6 mm) thick, smooth two sides (S2S); use for dust panels and other components indicated on drawings.
- H. Hardwood Edgebanding: Use solid hardwood edgebanding matching species, color, grain, and grade for exposed or semi-exposed portions of cabinetry adjacent to hardwood veneer.
 1. Thickness:.018 inch (.46 mm).

2.03 LAMINATE MATERIALS

- A. Manufacturers: Provide high pressure decorative laminates of one or combination of the following:
 1. Formica Corporation: www.formica.com.
 2. Panolam Industries International, Inc\Nevamar: www.nevamar.com.

3. Wilsonart: www.wilsonart.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Thermally Fused Laminate (TFL): Melamine resin, NEMA LD 3, Type VGL laminate panels.
 1. Color: White.
- C. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- D. Provide specific types as indicated.
 1. Horizontal Surfaces: HGS, 0.048 inch (1.22 mm) nominal thickness, selected from manufacturer's full range of standard colors, matte finish.
 2. Vertical Surfaces: VGS, 0.028 inch (0.71 mm) nominal thickness, selected from manufacturer's full range of standard colors, matte finish.
 3. Laminate Backer: BKL, 0.020 inch (0.51 mm) nominal thickness or thickness required by AWI/AWMAC/WI (AWS) standards, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.04 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
 1. Color: As selected by SJCF from manufacturer's full range.
 2. Thickness: 0.12 inch (3 mm).
- C. Adhesive for Bonding Edges: Hot-melt adhesive.
- D. Glass: Type A as specified in Section 08 80 00.
- E. Fasteners: Size and type to suit application.
- F. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- G. Anchors: Select material, type, size, and finish required by each substrate for secure anchorage. Provide hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or expansion sleeves for drilled-in-place anchors.
- H. Concealed Joint Fasteners: Threaded steel.
- I. Grommets: Standard plastic grommets for cut-outs, in color as selected from manufacturers standard colors and sizes.

2.05 HARDWARE

- A. Hardware: BHMA A156.9, types as scheduled or indicated for quality grade specified.
 1. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - a. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
- B. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, satin chrome finish, for nominal 1 inch (25 mm) spacing adjustments.
 1. Product: #346 Shelf Support manufactured by Knappe and Vogt or equal.
- C. Drawer and Door Pulls: "U" shaped wire pull, steel with satin chrome finish, 4 inch centers ("U" shaped wire pull, steel with chrome finish, 100 mm centers).
 1. Product: #116.39.464 manufactured by Hafele.

- D. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with satin finish.
 - 1. Product: For Swing Doors - C8053-14A with two keys, trim washer, spur washer (for wood) or flat washer (for metal), mounting nut and two cams; maximum 7/8 inch (22 mm) thick material, manufactured by CompX National or equal.
 - 2. Product: For Drawers - C8053-14A with two keys, trim washer, spur washer (for wood) or flat washer (for metal), mounting nut and two cams; maximum 7/8 inch (22 mm) thick material; cam stop at 12 o'clock. manufactured by CompX National or equal: www.compx.com
 - 3. Keying: Key each lock in a room the same. Key different rooms differently.
- E. Catches: Magnetic.
 - 1. Product: #592 manufactured by EPCO Sales, LLC.
 - 2. Provide where required or indicated on drawings
- F. Drawer Slides:
 - 1. Type: Full extension.
 - 2. Static Load Capacity: Commercial grade, 100 pounds (45 kg) static load minimum.
 - 3. Mounting: Side mounted.
 - 4. Stops: Integral type.
 - 5. Features: Provide self closing/stay closed type.
 - 6. Manufacturers:
 - a. Grass America Inc: www.grassusa.com.
 - b. Blum, Inc.; 430E Series: www.blum.com.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Hinges: Concealed hinge with 120 degree opening and full overlay, one pair for each leaf minimum, additional hinges as required for size and weight of door per manufacturer's recommendations, use sex bolts on back to back installation on a single divider, self-closing type, metal hinge, nickel plated.
 - 1. Manufacturers:
 - a. Grass America Inc; #3803 VS Hinge, Wing Base Plate and screws as recommended by manufacturer: www.grassusa.com.
 - b. Blum, Inc; #71T5550 Hinge, Wing Base Plate and screws as recommended by manufacturer: www.blum.com.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- H. File Drawer System: Provide file railing system at each file drawer; side rails and mounting end caps.
 - 1. Manufacturers:
 - a. Grass America Inc.; Pendaflex Rail System 2: www.grassusa.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- I. Optional Drawer System: Metal drawer system, metal side height 6 inch (150 mm) tall or required to fit drawer height; hardwood front, back and bottom.
 - 1. Manufacturers:
 - a. Grass America Inc.; Zargen #6236, 6200 full extension slides; provide Pendaflex Rail System #6110 at file drawers: www.grassusa.com.
 - b. Blum, Inc; Metabox #320H, 330 full extension slides; provide Metafile Rail system #ZRM.5500.US at file drawers: www.blum.com.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- J. Shelving Hardware: Heavy duty standards and brackets, 2 inch (51 mm) slot adjustment, front rest at each standard, color to be selected.
 - 1. Manufacturers:
 - a. Knappe & Vogt Manufacturing Company; #87 standards, #187 brackets, #211 front rest.: www.knappeandvogt.com.

- b. Substitutions: See Section 01 60 00 - Product Requirements.
- K. Wardrobe Hooks:
 - 1. Manufacturers:
 - a. Ives; #582 Double Wardrobe Hook: www.ives.ingersollrand.com.
 - b. Ives; #580 Double Ceiling Hook: www.ives.ingersollrand.com.
 - c. Ives; #572 Coat and Hat Hook: www.ives.ingersollrand.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- L. Elbow Catch: Install on inactive leaf of pair of doors with lock or where indicated or where required.
 - 1. Manufacturers:
 - a. Ives; Elbow Catch: www.ives.ingersollrand.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- M. Work Station Brackets: Angle wall bracket, 1000 pound (453 Kg) minimum load limit, longest size to fit countertop and wall, with mounting holes, 45 degree notch in corner for wall cleat, powder coat finish to be selected from manufacturer's standard colors.
 - 1. Manufacturers:
 - a. A & M Hardware; Work Station Bracket: www.aandmhardware.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- N. Door and Drawer Bumpers:
 - 1. Manufacturers:
 - a. Hafele; Clear Plastic Door Bumper: www.hafele.com/us/.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- O. Removable Panel Clips:
 - 1. Manufacturers:
 - a. Hafele; Keku Fasteners to suite project: www.hafele.com/us/.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units to the maximum extent possible and to permit passage through building openings.
 - 1. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- D. Edges: Ease edges to radius indicated for the following:
 - 1. Corners of cabinets and edges of solid wood (lumber) members less than 1 inch (1.6 mm) in nominal thickness: 1/16 inch (1.6 mm).
 - 2. Edges of rails and similar members more than 1 inch (25.4 mm) in nominal thickness: 1/8 inch (3.2 mm).
- E. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- F. Dovetail joints are not to be used for particle board construction.
- G. Shelving thickness as follows:
 - 1. 3/4 inch (19 mm) to a maximum span of 32 inch (813 mm), unless noted otherwise.
 - 2. 1 inch (25.4 mm) for spans over 32 inch (813 mm).

- H. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Locate counter butt joints minimum 2 feet (600 mm) from sink cut-outs.
 - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 - 2. Cap exposed or semi-exposed plastic laminate finish edges with plastic trim.
- I. Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes, and fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal cut edges.
- J. Shop glaze glass materials using the Interior Dry method as specified in Section 08 80 00.

2.07 FINISHING

- A. General: The entire finish of interior architectural woodwork is specified in this section, regardless of whether factory applied or applied by others after installation.
- B. Factory Finishing: Apply the final finish to architectural woodwork at factory to the greatest extent possible before delivery. Limit job site finishing to a minimum.
- C. Sand work smooth and set exposed nails and screws.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.
- C. Condition woodwork to average prevailing humidity conditions in installation areas before installing

3.02 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use fixture attachments in concealed locations for wall mounted components.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units.
- E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim for this purpose.
 - 1. Refinish cut surfaces or repair damaged finish at cuts.
- F. Secure cabinets to floor using appropriate angles and anchorages.
- G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.
- H. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.
- I. Maintain veneer sequence matching (if any) of cabinets with transparent finish.

3.03 ADJUSTING

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.
- C. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

- D. Touch up factory-applied finishes to restore damaged or soiled areas.

3.04 CLEANING AND PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensures that woodwork is being without damage or deterioration at time of Substantial Completion.
- B. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 07 19 00 - WATER REPELLENTS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Water / graffiti repellents applied to interior masonry surfaces.

1.02 REFERENCE STANDARDS

- A. ASTM D5095 - Standard Test Method for Determination of the Nonvolatile Content in Silanes, Siloxanes, and Silane-Siloxane Blends Used in Masonry Water Repellent Treatments; 1991 (Reapproved 2013).

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years experience.

1.05 FIELD CONDITIONS

- A. Protect liquid materials from freezing.
- B. Do not apply water / graffiti repellent when ambient temperature is lower than 40 degrees F (4 degrees C) or higher than 90 degrees F (32 degrees C).
- C. Surfaces shall be clean, dry, and free of alkali, efflorescence, sand, surface dust or dirt, oil, grease, chemical films, and other contaminants.
- D. Concrete surfaces should be fully cured.

PART 2 PRODUCTS**2.01 APPLICATIONS**

- A. Apply to entire wall face of all new interior exposed burnished block surfaces.

2.02 MATERIALS

- A. Water / Graffiti Repellent:
 - 1. Applications: Vertical surfaces.
 - 2. Number of Coats: As recommended by manufacturer of product for application type.
 - 3. Products:
 - a. PROSOCO Sure Klean Weather Seal Blok-Guard & Graffiti Control.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify joint sealants are installed and cured.
- C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.02 PREPARATION

- A. Protection of Adjacent Work:
 - 1. Protect adjacent property from drips and overspray.
 - 2. Protect adjacent surfaces not intended to receive water / graffiti repellent.
- B. Prepare surfaces to be coated as recommended by water / graffiti repellent manufacturer for best results.
- C. Do not start work until masonry mortar substrate is cured a minimum of 60 days.
- D. Remove loose particles and foreign matter.
- E. Remove oil and foreign substances with a chemical solvent that will not affect water / graffiti repellent.
- F. Scrub and rinse surfaces with water and let dry.
- G. Allow surfaces to dry completely to degree recommended by water / graffiti repellent manufacturer before starting coating work.

3.03 APPLICATION

- A. Apply water / graffiti repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.
- B. Apply at rate recommended by manufacturer, continuously over entire surface.
- C. Remove water / graffiti repellent from unintended surfaces immediately by a method instructed by water / graffiti repellent manufacturer.

END OF SECTION

SECTION 07 21 00 - THERMAL INSULATION**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Board insulation at cavity wall construction, perimeter foundation wall, and exterior wall behind MCM panel and metal panel wall finish.
- B. Batt insulation and vapor retarder in exterior wall construction.
- C. Batt insulation for filling perimeter window and door shim spaces, crevices in exterior wall and roof, and other areas where indicated on the plans.
- D. Sound attenuation blankets in stud walls and partitions.

1.02 RELATED REQUIREMENTS

- A. Section 05 40 00 - Cold-Formed Metal Framing: sheathing.
- B. Section 06 10 00 - Rough Carpentry: Supporting construction for batt insulation.
- C. Section 09 21 16 - Gypsum Board Assemblies: Where sound attenuation blankets inside stud walls and partitions is scheduled.

1.03 REFERENCE STANDARDS

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.
- B. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.
- C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.
- D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2014.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- F. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- G. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2012.
- H. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests; 2005 (Reapproved 2012).
- I. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics and performance criteria.
- C. Manufacturer's Installation Instructions: Include information on installation techniques.

1.05 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

1.06 DELIVERY, STORAGE AND PROTECTION

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

PART 2 PRODUCTS**2.01 APPLICATIONS**

- A. Insulation at perimeter of formed foundation walls: 1 1/2 inch (38.1 mm) extruded polystyrene board or 1 1/2 inch (38.1 mm) expanded polystyrene board.
- B. Insulation at perimeter of trenched foundation walls: 2 inch (50 mm) extruded polystyrene board or 2 inch (50 mm) expanded polystyrene board.
- C. Precast Walls:
 - 1. Insulation at precast walls: 1 1/2 inch (38 mm) polyisocyanurate board applied directly to back side of precast walls.
- D. Insulation at Metal Framed Walls:
 - 1. Metal stud backup with precast wall:
 - a. Within Stud: Reinforced-Foil-Faced, Glass-Fiber Blanket Insulation (FSK-25), R-Value (thickness) as indicated on drawings.
 - 2. Metal stud backup with Aluminum Composite Panels:
 - a. Within Stud: Reinforced-Foil-Faced, Glass-Fiber Blanket Insulation (FSK-25), where insulation is exposed to room or ceiling plenum. R-Value (thickness) as indicated on drawings.
 - b. Exterior face of stud and sheathing behind panels: 2 inch (50 mm) polyisocyanurate board where studs are exposed to room or ceiling plenum.
- E. Insulation at Metal Framed Ceilings or Soffits:
 - 1. Interior ceiling or exterior soffit:
 - a. Within Stud: Reinforced-Foil-Faced, Glass-Fiber Blanket Insulation (FSK-25), where insulation is exposed to room or ceiling plenum. R-Value (thickness) as indicated on drawings.
 - b. Exterior face of stud: 2 inch (50 mm) polyisocyanurate board.

2.02 FOAM BOARD INSULATION MATERIALS

Reference Applications above this section for location and thickness of each type of insulation board.

- A. Expanded Polystyrene (EPS) Board Insulation: ASTM C578, Type IX; with the following characteristics:
 - 1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 - 3. Board Edges: Square.
 - 4. Water Absorption: 2 percent by volume, maximum.
 - 5. Compressive Resistance: 25 psi (173 kPa).
 - 6. Manufacturers:
 - a. AFM Corp: www.r-control.com.
 - b. Diversifoam Products: www.diversifoam.com.
 - c. Insulfoam LLC: www.insulfoam.com/#sle.
 - d. ACH Foam Technologies: www.achfoam.com.

7. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Extruded Polystyrene Board Insulation: Extruded polystyrene board; ASTM C578; with either natural skin or cut cell surfaces, and the following characteristics:
 1. Type: ASTM C578, Type IV.
 2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 4. R-value (RSI-value); 1 inch (25 mm) of material at 72 degrees F (22 C): 5 (0.88), minimum.
 5. Board Edges: Square.
 6. Water Absorption, Maximum: 0.3 percent, by volume.
 7. Manufacturers:
 - a. Dow Chemical Company; STYROFOAM CAVITYMATE Ultra: www.dow.com/#sle.
 - b. Kingspan Insulation LLC; GreenGuard XPS TYPE IV 25 PSI: www.trustgreenguard.com/#sle.
 - c. Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com/#sle.
 8. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Polyisocyanurate Board Insulation with Facers Both Sides: Rigid cellular foam, complying with ASTM C1289; Type I, aluminum foil both faces; Class 1, non-reinforced foam core.
 1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 3. Compressive Strength: 16 psi (110 kPa)
 4. Thermal Resistance: R-value (RSI-value) of 6.5 (1.14) per 1 inch (25 mm) determined in accordance with ASTM C518 using stabilized R-Values @ 75 degrees F (23.8 degreeec C) mean temperature.
 5. Board Edges: Square.
 6. Manufacturers:
 - a. Hunter Panels, LLC; Xci Class A Foil: www.hunterxci.com/#sle.
 - b. Rmax Inc; Thermasheath-3: www.rmax.com/#sle.
 7. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 BATT INSULATION MATERIALS

Reference Applications above this section for location and thickness of each type of batt insulation.

- A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 1. Material: Glass fiber.
 2. Reinforced-Foil-Faced, Glass-Fiber Blanket Insulation (FSK-25): Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.
 3. Sound Attenuation Blankets: Spun Mineral Fiber, Type I (insulation without facing), Density and thickness required for STC shown.
 4. Manufacturers:
 - a. CertainTeed Corporation: www.certainteed.com.
 - b. Johns Manville: www.jm.com.
 - c. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

- d. Knauf Insulation: www.knaufusa.com.
- e. Thermafiber, Inc: www.thermafiber.com.
- 5. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ACOUSTICAL ROLL MATERIALS ABOVE PERFORATED METAL PAN CEILING

- A. Glass Fiber Roll Insulation: ASTM C612 Type 1A, coated black face coating roll insulation with no printing permitted on face surface with the following characteristics:
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 50 or less, when tested in accordance with ASTM E84.
 - 3. Roll Size: 24 inches (610 mm) wide to fit between tie wires.
 - 4. Roll Thickness: 2 inches (51 mm).
 - 5. NRC: 1.00 with Type "A" Mounting per ASTM E795.
 - 6. Manufacturers:
 - a. Johns Manville Corporation; Insul-SHIELD coated black rolls: www.jm.com.
 - 7. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 ACCESSORIES

- A. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch (50 mm) wide, as recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- B. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.
- C. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place. Provide Peel and Press manufactured by Gemco: www.gemcoinsulation.com, Tactoo manufactured by AGM Industries: www.agmind.com or equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Verify substrate surfaces are flat, free of honeycomb, fins, or irregularities.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. Apply manufacturer's recommended adhesive to back of boards:
 - 1. Three continuous beads per board length.
 - 2. Full bed 1/8 inch (3 mm) thick.
- B. Install boards horizontally on foundation perimeter.
 - 1. Butt edges and ends tightly to adjacent boards and to protrusions.
- C. Extend boards over expansion joints, unbonded to foundation on one side of joint.
- D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT EXTERIOR WALLS

- A. Install boards horizontally on walls.
 - 1. Butt edges and ends tightly to adjacent boards and to protrusions.
 - 2. Press units firmly against inside substrates.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.04 BOARD INSTALLATION AT CAVITY WALLS

- A. Install boards horizontally on walls.
 - 1. Butt edges and ends tightly to adjacent boards and to protrusions.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.05 BATT INSTALLATION

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install in exterior wall and ceiling spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. Maintain 3 inch (76 mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
- F. Faced Batt Insulation:
 - 1. Install with factory applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.
 - 2. Where no framing and other supports are present retain insulation batts in place with spindle fasteners at 12 inch (300 mm) on center.
 - 3. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.
- G. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

3.06 ACOUSTICAL ROLL MATERIALS ABOVE PERF. METAL PAN CEILING

- A. Install roll material to fit snugly between wire ties.
- B. Black coated face installed downward, exposed to finish space. No lettering exposed to finish space.

3.07 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 25 00 - WEATHER BARRIERS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Vapor Retarders: Materials to make exterior walls and joints around frames of openings in exterior walls water vapor resistant and air tight.
- B. Air Barriers: Materials that form a system to stop passage of air through exterior walls and joints around frames of openings in exterior walls.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.
- B. Section 07 21 00 - Thermal Insulation: Vapor retarder installed in conjunction with batt insulation.

1.03 DEFINITIONS

- A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.
- B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.
- C. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.
 - 1. Water Vapor Permeance: For purposes of conversion, $57.2 \text{ ng}/(\text{Pa s sq m}) = 1 \text{ perm}$.

1.04 REFERENCE STANDARDS

- A. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.
- B. AATCC Test Method 127 - Water Resistance: Hydrostatic Pressure Test; 2014.
- C. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2013).
- D. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2013.
- E. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications; 2010.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- H. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2011.
- I. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.
- J. ICC-ES AC308 - Acceptance Criteria for Water-Resistive Barriers; ICC Evaluation Service, Inc; 2013.
- K. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials; ICC Evaluation Service, Inc; 2011.

- L. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing; ICC Evaluation Service, Inc; 2015.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on material characteristics.
- C. Shop Drawings: Provide drawings of special joint conditions.
- D. Manufacturer's Installation Instructions: Indicate preparation.

1.06 MOCK-UP

- A. Install mock-up using approved weather barrier assembly including fasteners, flashing, tape and related accessories per manufacturer's current printed instructions and recommendations.
 - 1. Mock-up size: 5 x 5 feet (1.5 x 1.5 m).
 - 2. Mock-up Substrate: Match wall assembly construction, including window opening.
 - 3. Mock-up may remain as part of the work

1.07 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

- A. Air Barrier:
 - 1. On outside surface of sheathing of exterior walls and soffits for metal wall panels and metal composite material wall panels use air barrier membrane.
- B. Interior Vapor Retarder:
 - 1. On inside face of studs of exterior walls, under cladding or gypsum board, taped foil faced insulation shall serve as vapor retarder.

2.02 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

- A. Air Barrier Membrane:
 - 1. Material: Water-based acrylic, polymer-modified bitumen, or polyether-based polymer, with VOC content of zero.
 - 2. Acceptable Substrates: Stated by manufacturer as suitable for installation on visibly damp surfaces and concrete that has hardened but is not fully cured ("green" concrete) without requiring a primer.
 - 3. Adhesion to Paper and Glass Mat Faced Sheathing: Sufficient to ensure failure due to delamination of sheathing.
 - 4. Dry Film Thickness: 30 mils (0.030 inch) (0.76 mm), minimum.
 - 5. Air Permeance: 0.004 cubic feet per minute per square foot (0.02 L/s/sq m), maximum, when tested in accordance with ASTM E2178.
 - 6. Water Vapor Permeance: 12 perms (689 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M, Procedure B.
 - 7. Ultraviolet and Weathering Resistance: Approved in writing by manufacturer for minimum of 6 months weather exposure.
 - 8. Elongation: 300 percent, minimum, when tested in accordance with ASTM D412.
 - 9. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 - 10. Nail Sealability: Pass, when tested in accordance with ASTM D1970/D1970M.
 - 11. VOC Content: 250 g per L or less.

12. Sealants, Tapes and Accessories: As recommended by coating manufacturer.
13. Products:
 - a. Carlisle Coatings and Waterproofing, Inc; Fire Resist Barritech-VP: www.carlisleccw.com/#sle.
 - b. Epro Services, Inc; ECOFLEX-PS: www.eproserv.com/#sle.
 - c. GCP Applied Technologies; Perm-A-Barrier VPL: www.gcpat.com/#sle.
 - d. Henry Company; Air-Bloc 31MR: www.henry.com/#sle.
 - e. Parex USA, Inc; Parex USA WeatherSeal Trowel-on (without gauging aggregate): www.parexusa.com/#sle.
 - f. Sto Corp; Sto AirSeal: www.stocorp.com/#sle.
 - g. W.R. Meadows, Inc; Air-Shield LMP: www.wrmeadows.com/#sle.
 - h. Tremco Sealants & Waterproofing; ExoAir 220: www.tremcosealants.com.
 - i. Prosoco, Inc.; R-Guard VB: www.prosoco.com.
 - j. DuPont Building Innovations; Tyvek Fluid Applied WB with Tyvek Fluid Applied Flashing and Joint Compound, Sealant for Tyvek Fluid Applied System and StraightFlash: www.dupont.com.
 - k. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 VAPOR RETARDER MATERIALS (AIR BARRIER AND WATER-RESISTIVE)

- A. Vapor Retarder Sheet: (foil faced insulation)
 1. Seam and Perimeter Tape: Refer to 07 21 00 Thermal Insulation.

2.04 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.
- B. Thinners and Cleaners: As recommended by material manufacturer.
- C. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's instructions.
- C. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- D. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- C. Vapor Retarders: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

- D. Apply sealants within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.
- E. Vapor Retarder On Interior:
 - 1. When insulation is to be installed in assembly, install vapor retarder over insulation.
 - 2. Anchor to metal framing using seam tape, adhering at least one-half of tape width to substrate.
 - 3. Seal seams, laps, perimeter edges, penetrations, tears, and cuts with self-adhesive tape, making air tight seal.
 - 4. Seal entire perimeter to structure, window and door frames, and other penetrations.
 - 5. Where conduit, pipes, wires, ducts, outlet boxes, and other items are installed in insulation cavity, pass vapor retarder sheet behind item but over insulation and maintain air tight seal.
- F. Coatings:
 - 1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.
 - 2. Joint Treatment:
 - a. Gypsum Sheathing: Fill joints greater than 1/4 inch (6 mm) with sealant according to ASTM C1193 and air-barrier manufacturer's written instructions. Apply first layer of fluid air-barrier material at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air-barrier material over joint reinforcing strip.
 - 3. Transition Strip Installation:
 - a. General: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
 - 4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 - a. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats per manufacturer's recommendations.
 - 5. Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.
- G. Openings and Penetrations in Exterior Weather Barriers:
 - 1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches (125 mm) onto weather barrier and at least 6 inches (150 mm) up jambs; mechanically fasten stretched edges.
 - 2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with at least 4 inches (100 mm) wide; do not seal sill flange.
 - 3. At openings to be filled with non-flanged frames, seal weather barrier to all sides of opening framing, using flashing at least 9 inches (230 mm) wide, covering entire depth of framing.
 - 4. At head of openings, install flashing under weather barrier extending at least 2 inches (50 mm) beyond face of jambs; seal weather barrier to flashing.
 - 5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
 - 6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Coordination of ABAA Tests and Inspections:
 - 1. Provide testing and inspection required by ABAA QAP.
 - 2. Notify in ABAA writing of schedule for air barrier work. Allow adequate time for testing and inspection.
 - 3. Cooperate with ABAA testing agency.
 - 4. Allow access to air barrier work areas and staging.
 - 5. Do not cover air barrier work until tested, inspected, and accepted.
- C. Do not cover installed weather barriers until required inspections have been completed.
- D. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.
- E. Take digital photographs of each portion of the installation prior to covering up.

3.05 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07 42 13.23 - METAL COMPOSITE MATERIAL WALL PANELS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Exterior cladding consisting of formed metal composite material (MCM) sheet, secondary supports, and anchors to structure, attached to solid backup.
- B. Matching flashing and trim.

1.02 RELATED REQUIREMENTS

- A. Section 05 40 00 - Cold-Formed Metal Framing: Panel support framing.
- B. Section 06 10 00 - Rough Carpentry: Sheathing.
- C. Section 07 25 00 - Weather Barriers: Weather barrier behind rainscreen wall system.
- D. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashing components integrated with this wall system.
- E. Section 07 92 00 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.

1.03 REFERENCE STANDARDS

- A. ASTM D1781 - Standard Test Method for Climbing Drum Peel for Adhesives; 1998 (Reapproved 2012).
- B. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2014.
- C. ASTM D2244 - Standard Practice for Calculation of Color Differences from Instrumentally Measured Color Coordinates; 2011.
- D. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 2007.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- F. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
- G. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
- H. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data - MCM Sheets: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:
 - 1. Finish manufacturer's data sheet showing physical and performance characteristics.
 - 2. Storage and handling requirements and recommendations.
 - 3. Fabrication instructions and recommendations.
 - 4. Specimen warranty for finish, as specified herein.
- C. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:

1. Physical characteristics of components shown on shop drawings.
 2. Storage and handling requirements and recommendations.
 3. Installation instructions and recommendations.
 4. Specimen warranty for wall system, as specified herein.
- D. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, number of anchors, supports, reinforcement, trim, flashings, and accessories.
1. Indicate panel numbering system.
 2. Differentiate between shop and field fabrication.
 3. Indicate substrates and adjacent work with which the wall system must be coordinated.
 4. Include large-scale details of anchorages and connecting elements.
- E. Selection Samples: For each finish product specified, submit color chips representing manufacturer's full range of available colors and patterns.
- F. Test Report: Submit report of full-size mock-up tests for air infiltration, water penetration, and wind performance.
- G. Manufacturer's Qualification Statement.
- H. Installer's Qualification Statement.
- I. Testing Agency's Qualification Statement.
- J. Maintenance Data: Care of finishes and warranty requirements.

1.05 QUALITY ASSURANCE

- A. Field Measurements: Installer shall verify actual dimensions by field measurement before fabrication; show recorded measurements on shop drawings.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section.
1. With not less than ten years of experience.
 2. The panel system fabricator and attachment system shall be approved by MCM sheet manufacturer.
- C. Installer Qualifications: Company specializing in performing work of the type specified in this section.
1. With minimum five years of experience.
 2. Company shall be within a 100 mile (160 km) radius of the project site.
- D. Testing Agency Qualifications: Independent agency experienced in testing assemblies of the type required for this project and having the necessary facilities for full-size mock-up testing of the type specified.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
1. Protect finishes by applying heavy duty removable plastic film during production. Remove within 60 days of delivery to the job site.
 2. Package for protection against transportation damage.
 3. Provide markings to identify components consistently with drawings.
 4. Exercise care in unloading, storing and installing panels to prevent bending, warping, twisting and surface damage.
- B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
1. Store in well ventilated space out of direct sunlight.

2. Protect from moisture and condensation with tarpaulins or other suitable weather tight covering installed to provide ventilation.
3. Store at a slope to ensure positive drainage of any accumulated water.
4. Do not store in any enclosed space where ambient temperature can exceed 120 degrees F (49 degrees C).
5. Avoid contact with any other materials that might cause staining, denting, or other surface damage.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Manufacturers Wall System Warranty: Provide written warranty by manufacturer, agreeing to correct defects in manufacturing within a three year period after Date of Substantial Completion.
- C. Installers Wall System Warranty: Provide written warranty by installer, agreeing to correct defects in installation within a two year period after Date of Substantial Completion.
- D. MCM Sheet Manufacturer's Finish Warranty: Provide manufacturer's standard written warranty for a minimum of a 20 year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Composite Material Sheet Manufacturers:
 1. Alcoa, Inc; Reynobond ACM: www.alcoa.com/#sle.
 2. ALPOLIC Materials; ALPOLIC/fr (Fire Retardant core): www.alpolic-america.com/#sle.
 3. Citadel Architectural Products, Inc; Envelope 2000: www.citadelap.com/#sle.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Wall Panel System Manufacturers:
 1. Citadel Architectural Products, Inc; Envelope 2000 Rout and Return (RR) System: www.citadelap.com/#sle.
 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 WALL PANEL SYSTEM

- A. Wall Panel System: Metal panels, fasteners, and anchors designed to be supported by framing or other substrate provided by others; provide installed panel system capable of maintaining specified performance without defects, damage or failure.
 1. Anchor panels to supporting framing with concealed fasteners.
 2. The panel system is to be of a rout and return system utilizing a continuous 1/2" sealant joint recessed 1/4" in panel joints.
 3. Smooth clear satin anodized aluminum finish.
- B. Performance Requirements:
 1. The listing of a product name, system, or fabricator does not constitute approval unless all performance criteria are met. Provide a composite building panel system which has been pretested and certified by an independent testing laboratory to provide specified resistance to air and water infiltration and structural deflection, when installed. Systems that are not pretested and certified by an independent laboratory prior to bid are unacceptable. The use of a panel manufacturer's generic tests reports are unacceptable; the tests must be for the specific system submitted by the panel system engineer and fabricator.
 2. Thermal Movement: Provide for free and noiseless vertical and horizontal thermal movement due to expansion and contraction under material temperature range of

- minus 20 degrees F (minus 29 degrees C) to 180 degrees F (82 degrees C) without buckling, opening of joints, undue stress on fasteners, or other detrimental effects; allow for ambient temperature at time of fabrication, assembly, and erection procedures.
3. Wind Performance: Provide system tested in accordance with ASTM E330/E330M without permanent deformation or failures of structural members under the following conditions:
 - a. Inward Design Wind Pressure: 20 psf (957 kPa).
 - b. Outward Design Wind Pressure: 20 psf (957 kPa).
 - c. Maximum deflection of perimeter framing member of L/175 normal to plane of the wall; maximum deflection of individual panels of L/60.
 - d. Maximum anchor deflection in any direction of 1/16 inch (1.6 mm) at connection points of framing members to anchors.
 4. Air Infiltration: 0.06 cfm/sq ft (0.003 L/s/sq m) of wall area, maximum, when tested at 1.57 psf (0.075 kPa) in accordance with ASTM E283.
 5. Water Penetration: No water penetration under static pressure when tested in accordance with ASTM E331 at a differential of 10 percent of inward acting design load, 6.24 psf (0.299 kPa) minimum, after 15 minutes.
 - a. Water penetration is defined as the appearance of uncontrolled water on the interior face of the wall.
 - b. Design to drain leakage and condensation to the exterior face of the wall.
- C. Panels: Fabricate and finish metal-faced composite wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
1. Detail and fabricate panels to the sizes, configurations and layouts as shown on the elevation drawings and sections. Panel system fabricator's shop drawings will provide for flat panel surfaces within the tolerances and performance requirements of the panel manufacturer.
 2. In the interest of maintaining job schedules, the panel system fabricator will fabricate all of the materials from the approved set of shop drawings. Field verification of dimensions are required and the General Contractor/Subcontractor shall be responsible to supply these dimensions to the panel system fabricator prior to engineering/fabricating of the materials. Discrepancies found during field verification shall be corrected by the General Contractor at no cost to the panel system fabricator; however, if the discrepancies should cause any revision, addition, or delays to the work, the discrepancies will not be subject to increased cost to the Owner and/or changes in schedule.
 3. Grain pattern of anodized and metallic finished aluminum facing sheets to run in same direction, unless otherwise specified.
 4. Panel system to be field sealed between panels with silicone materials as recommended by the panel system fabricator and per manufacturers installation instructions. Sealant is to be installed by the panel installer.
 5. Panels shall be marked to coordinate with the approved shop drawings.

2.03 MATERIALS

- A. Metal Composite Material (MCM) Sheet: Two sheets of aluminum sandwiching a solid core of extruded thermoplastic or thermoset phenolic resin material; core material free of voids and spaces; no foamed insulation material content.
1. Overall Sheet Thickness: 4 mm, minimum.
 2. Face Sheet Thickness: 0.019 inches (0.50 mm), minimum.
 3. Alloy: Manufacturer's standard, selected for best appearance and finish durability.

4. Bond and Peel Strength: No adhesive failure of the bond between the core and the skin nor cohesive failure of the core itself below 22.4 inch-pound/inch (100 N-mm/mm) with no degradation in bond performance, when tested in accordance with ASTM D1781, simulating resistance to panel delamination, after 8 hours of submersion in boiling water and after 21 days of immersion in water at 70 degrees F (21 degrees C).
5. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
6. Flammability: Self-ignition temperature of 650 degrees F (343 degrees C) or greater, when tested in accordance with ASTM D1929.
- B. Metal Framing Members: Include sub-girts, zee-clips, base and sill angles and channels, hat-shaped and rigid channels, and furring channels required for complete installation.
 1. Provide material strength, dimensions, configuration as required to meet the applied loads applied and in compliance with applicable building code.
- C. Flashing: smooth clear anodized aluminum; gages indicated.
- D. Fasteners:
 1. Exposed fasteners: Stainless steel or coated carbon; permitted only where absolutely unavoidable and subject to prior approval of the SJCF.
- E. Joint Sealer: Silicone sealant approved by MCM sheet manufacturer.
 1. Color to be selected by architect from manufacturer's full and complete standard color selector card. All metal surfaces to be primed per recommendations and instructions of sealant manufacturer prior to sealant installation.
- F. Provide panel system manufacturer's and installer's standard corrosion resistant accessories, including fasteners, clips, anchorage devices and attachments.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and interfaces with other work.
- B. Verify substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturers written instructions.
- C. If substrate preparation is the responsibility of another installer, notify SJCF of unsatisfactory preparation before proceeding.
- D. Notify SJCF in writing of conditions detrimental to proper and timely completion of work. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Protect adjacent work areas and finish surfaces from damage during installation.

3.03 INSTALLATION

- A. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.
- B. Comply with instructions and recommendations of MCM sheet manufacturer and wall system manufacturer, as well as with approved shop drawings.
- C. Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.
- D. Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component

parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.

- E. Provide weather barrier system over sheathing as indicated in 07 25 00 Weather Barriers.
- F. Use concealed fastening system of non-corrosive type fasteners as recommended by the panel systems manufacturer. These fasteners to occur under all panels.
- G. Sealant at perimeter panel joints to be installed as part of the related specifications.
- H. Installer to prime metal surfaces as recommended by sealant manufacturer. Install sealant in accordance with sealant manufacturer's recommendations. Finished sealant joints to have clean edges.
- I. Attachment System: Freely allow thermal movement of each panel.
 - 1. Fasteners into or attached to panels are not permitted.
 - 2. Panels to use a continuous perimeter extrusion in a routed configuration.
 - 3. 45 degree corners shall be back mitered as a continuous panel with no attachment extrusion piece used.
- J. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.
- K. Install flashings as indicated on shop drawings. At flashing butt joints, provide a lap strap under flashing and seal lapped surfaces with a full bed of non-hardening sealant.
- L. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections maintaining the following installation tolerances:
 - 1. Variation From Plane or Location: 1/2 inch in 30 feet (10 mm in 10 m) of length and up to 3/4 inch in 300 feet (20 mm in 100 m), maximum.
 - 2. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet (3 mm in 9 m) run, maximum.
 - 3. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet (3 mm in 9 m) run, maximum.
 - 4. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch (0.75 mm), maximum.
- M. Replace damaged products.
 - 1. Exception: Field repairs of minor damage to finishes are permitted only when approved in writing by SJCF, panel manufacturer, and fabricator.

3.04 CLEANING

- A. Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.
- B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work. Remove within 60 days of delivery to the job site.
- C. Remove temporary coverings and protection of adjacent work areas.
- D. Clean installed products in accordance with manufacturer's instructions.

3.05 PROTECTION

- A. Protect installed panel system from damage until Date of Substantial Completion.

END OF SECTION

SECTION 07 54 00 - THERMOPLASTIC MEMBRANE ROOFING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Adhered system with thermoplastic roofing membrane.
- B. Insulation, flat and tapered as indicated on the drawings.
- C. Deck sheathing.
- D. Flashings.
- E. Roofing stack boots, roofing expansion joints, and walkway pads.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Wood nailers and curbs.
- B. Section 340 - 340: Counterflashings.

1.03 REFERENCE STANDARDS

- A. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2007a (Reapproved 2011).
- B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.
- C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.
- D. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.
- E. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2014.
- F. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.
- G. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing; 2013.
- H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- I. CAN-ULC-S770 - Standard Test Method Determination of L-Term Thermal Resistance Of Closed-Cell Thermal Insulating Foams; 2009.
- J. FM 4470 - Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for use in Class 1 and Noncombustible Roof Deck Construction; 2012.
- K. FM DS 1-28 - Wind Design; 2007.
- L. FM DS 1-29 - Roof Deck Securement and Above-Deck Roof Components; Factory Mutual System; 2006.
- M. ITS (DIR) - Directory of Listed Products; current edition.
- N. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; 2010.
- O. SPRI ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems; 2011.
- P. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.
- Q. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, fasteners, and for all other products employed on this project.
- C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, mechanical fastener layout, and recommended details modified to fit project conditions.
 - 1. Fastener Layout: Patterns for corner, perimeter and field-of-roof locations.
 - 2. Tapered insulation: Include slopes.
 - 3. Layout: Include walkway pads and grease resistant sheet locations and dimensions.
- D. Installer's qualification data.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Warranty Documentation:
 - 1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with at least ten years of experience and approved by manufacturer.
 - 1. Approval shall be valid and current at time of bidding and installation, in writing, by manufacturer and experienced in application of specified thermoplastic membrane roofing system on at least 3 projects; one at least as large as this project.
 - 2. Installer shall be responsible for all work associated with thermoplastic membrane roofing, including (but not limited to) preparation, insulation, flashing and counterflashing, expansion joints, and joint sealers.
 - 3. Company shall be within a 100 mile (160 km) radius of the project site.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.
- B. Store products in weather protected environment, clear of ground and moisture.
- C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.
- D. Protect foam insulation from direct exposure to sunlight.
- E. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck and do not overload structure.

1.07 FIELD CONDITIONS

- A. Do not apply roofing membrane during unsuitable weather.
- B. Do not apply roofing membrane when ambient temperature is below 40 degrees F (5 degrees C).
- C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- D. Do not expose materials vulnerable to water in quantities greater than can be weatherproofed the same day.
- E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. General Warranty: The warranties 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.
- C. System Warranty: Provide manufacturer's 15 year total system warranty with extended wind speed coverage of 90 mph (145 kilometer per hour) ground wind-speed without monetary limitation (NDL) and not pro-rated; signed by the roofing system manufacturer agreeing to promptly repair leaks resulting from defects in materials or workmanship. Owner's signature is not required.
 - 1. All roof related sheet metal shall be included in the warranty including copings, flashings, counterflashings etc.
 - 2. Roof edge products shall be included in the warranty for the same duration as the roofing system.
 - 3. Roofing system shall be designed to withstand wind speed at 32.8 feet (10 m) above ground level.
- D. Membrane Warranty: Provide a 20 year membrane warranty signed by the roofing manufacturer warranting that the membrane will be free from manufacturing defects and that the membrane will not prematurely deteriorate to the point of failure.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Thermoplastic Polyolefin (TPO) Membrane Materials:
 - 1. Carlisle Roofing Systems, Inc; Sure-Weld TPO: www.carlisle-syntec.com/#sle.
 - 2. Firestone Building Products, LLC; Ultra Ply: www.firestonebpco.com.
 - 3. GAF; EverGuard TPO 60 mil: www.gaf.com/#sle.
 - 4. GenFlex Roofing Systems, LLC; GenFlex TPO: www.genflex.com.
 - 5. Johns Manville; JM TPO: www.jm.com/#sle.
 - 6. Versico, a division of Carlisle Construction Materials Inc; VersiWeld TPO: www.versico.com/#sle.
 - 7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ROOFING

- A. Thermoplastic Membrane Roofing at Addition: One ply membrane, fully adhered, over insulation and cover board.
- B. Thermoplastic Membrane Roofing at Existing: One ply membrane, fully adhered, over lightweight concrete or gypsum, where occurs.
- C. Roofing Assembly Requirements:
 - 1. Source Limitations: Obtain all components including but not limited to roof insulation, fasteners, membrane materials and flashing materials from the same manufacturer as the membrane roofing. All components shall be manufactured and labeled from the same manufacturer to provide a total system warranty.
 - 2. Fire Resistance Rating: Provide materials which have been tested and listed by UL (DIR) for application indicated, with Class A for noncombustible decks, Class A for combustible decks, rated materials/system for roof slopes less than 1/2 inch (12.7 mm) per foot.
 - 3. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

4. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in Approval Standard FM 4450 and FM 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
 - a. Fire/Windstorm Classification: Class 1-90 accordance to FM Global Property Loss Prevention Data Sheet FM DS 1-29.
5. Insulation Thermal Value:
 - a. Polyisocyanurate Board: Insulation values shall be in accordance with Long Term Thermal Resistance (LTTR) values as determined by CAN-ULC-S770. Isocyanurate board to be 5.2 inch (132.1 mm) thick minimum.
 - b. Expanded Polystyrene board shall be based on 75 deg F (23.9 deg C) heat loss.
 - c. The insulation (in uniform thickness) shall provide R-30 thermal resistance.
Coverboard, deck sheathing and insulation used to create crickets is not to be included in calculating minimum R value.
- D. Acceptable Insulation Types - Constant Thickness Application:
 1. Minimum 2 layers of polyisocyanurate or expanded (molded) polystyrene.
- E. Acceptable Insulation Types - Tapered Application:
 1. Minimum 2 layers of constant thickness application below tapered application.
 2. Tapered polyisocyanurate or expanded (molded) polystyrene board.
- F. Cover Board - Required as a cover over the insulation board, no exceptions.
- G. Deck Sheathing - Required for a thermal barrier under polystyrene insulation or for rated roof/ceiling assembly where indicated on the code or roof plan.
 1. Per IBC, a thermal barrier is not required for polystyrene insulation above non-perforated decks, provided the assembly with the insulation passes FM 4450 or UL 1256. Verify gage of deck installed with the tested system requirements. Must submit information on assembly passing indicated test.

2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

- A. Membrane:
 1. Material: Thermoplastic polyolefin (TPO) complying with ASTM D6878/D6878M.
 2. Reinforcing: Internally fabric or scrim reinforced.
 3. Thickness: 60 mil 0.060 inch (1.5 mm), minimum.
 4. Sheet Width: Factory fabricated into largest sheets possible.
- B. Seaming Materials: As recommended by membrane manufacturer.
- C. Flexible Flashing Material: Same material as membrane.

2.04 DECK SHEATHING AND COVER BOARDS

- A. Deck Sheathing for Fire Rated Assemblies or for Thermal Barrier: Gypsum sheathing, ASTM C1396/C1396M, Type X special fire resistant type, 5/8 inch (16 mm) thick.
- B. Deck Sheathing for Thermal Barrier: Glass mat faced gypsum panels, ASTM C1177/C1177M, fire resistant type, 1/2 inch (13 mm) thick.
- C. Cover Board: Provide and install one of the following which meets warranty requirements.
 1. ASTM C1177/C1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch (13 mm) thick, factory primed.
 - a. Manufacturers:
 - 1) Georgia-Pacific Corporation; Dens Deck Prime: www.gp.com.
 - 2) National Gypsum Company; DEXcell FA: www.nationalgypsum.com.
 2. ASTM C1278/C1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/2 inch (13 mm) thick.

- a. Manufacturers:
 - 1) USG Corporation; Securock: www.usg.com.
- 3. For extended wind speed coverage of 100 mph (161 kilometers per hour): PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.

2.05 INSULATION

- A. General: Provide preformed roof insulation boards that comply with requirements, selected from manufacturer's standard sizes and of thicknesses indicated as required by membrane system manufacturer.
- B. Provide preformed saddles, crickets, tapered edge strips and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated; back slope must provide minimum 1/4 inch per 12 inches (6.35 mm per 304.8 mm).
- C. Molded Expanded Polystyrene (EPS) Board Insulation: ASTM C578, Type II; molded expanded polystyrene board with the following characteristics:
 - 1. Board Density: 1.35 lb/cu ft (22 kg/cu m).
 - 2. Compressive Resistance: 15 psi (104 kPa).
- D. Polyisocyanurate Board Insulation: Rigid cellular foam, complying with ASTM C1289, Type II, Class 1, cellulose felt or glass fiber mat both faces; Grade 3 and with the following characteristics:
 - 1. Compressive Strength: 25 psi (172 kPa).

2.06 METAL EDGING

- A. Coping: Metal coping cap with anchor/support cleats for capping any parapet wall. The system shall be watertight, maintenance free and does not require exposed fasteners. Anchor/support cleat of 20 gauge galvanized metal, 12 inch (304.8 mm) wide and spaced 48 inch (1219.2 mm) on center, with stainless steel spring attached to cleat. Anchor/support cleat fasteners shall be stainless steel and sizes as recommended by manufacturer. Joints shall be a butt type with 8 inch (203.2 mm) concealed splice plates set with non-curing sealant strips. Custom radius as required.
 - 1. Outside face height of 3 1/2 inch (88.9 mm). Inside face height of 3 1/2 inch (88.9 mm)
 - 2. Tested per SPRI ES-1 Standard and installed per roofing manufacturer's requirements.
 - 3. Exterior coping of 24 gauge galvanized steel with polyvinylidene fluoride system finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 4. Coping Finishes: Select from manufacturer's standard colors.

2.07 ACCESSORIES

- A. General: Provide products which are recommended by manufacturers to be fully compatible with indicated substrates, or provide separation materials as required by manufacturer to eliminate contact between incompatible materials.
- B. Expansion Joint Covers: Composite construction of flexible EPDM flashing of black color with closed cell urethane foam backing, each edge seamed to aluminum sheet metal flanges, designed for nominal joint width of 1 inch (25 mm) or as indicated on drawings. Include special formed corners, tees, intersections, and wall flashings, each sealed watertight.
- C. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.
- D. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers. Do not penetrate through lower pan of acoustical decks.
- E. Membrane Adhesive: As recommended by membrane manufacturer.
- F. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.
- G. Sealants: As recommended by membrane manufacturer.
- H. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- I. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
 1. Composition: Rubber with mineral granule surface.
 2. Size: Manufacturer's standard size(s).
 3. Surface Color: White or yellow.
- J. Metal Termination Bars: Manufacturer's standard aluminum bars, approximately 1 inch (25 mm) wide, roll formed and pre-punched.
- K. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, in-seam sealants, termination reglets and other accessories recommended by roofing system manufacturer for intended use.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set and are in place.

3.02 CONCRETE DECK PREPARATION

- A. Verify adjacent precast concrete roof members do not vary more than 1/4 inch (6 mm) in height. Verify grout keys are filled flush.
- B. Fill surface honeycomb and variations with latex filler.
- C. Confirm dry deck by moisture meter with 12 percent moisture maximum.

3.03 METAL DECK PREPARATION

- A. Install deck sheathing on metal deck:
 1. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.
 2. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.

3.04 INSTALLATION - GENERAL

- A. Perform work in accordance with manufacturer's instructions.
- B. Do not apply roofing membrane during unsuitable weather.
- C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.

- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- E. Do not expose materials vulnerable to water in quantities greater than can be weatherproofed the same day.
- F. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove rood-drain plugs when no work is taking place or when rain is forecast.
- G. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of the roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.05 INSULATION APPLICATION - UNDER MEMBRANE

- A. Attachment of Insulation:
 - 1. Mechanically fasten insulation to deck in accordance with roofing manufacturer's instructions and Factory Mutual requirements for specified Windstorm Resistance Classification.
 - a. Use fastener type and fastening pattern as required to achieve wind resistance specified.
 - b. Spacing requirements at corners and perimeter must be strictly followed. Length of fasteners must meet manufacturer's requirement for deck penetration, but shall not penetrate the bottom flute or plate of metal decking.
- B. Lay subsequent layers of insulation with joints staggered minimum 6 inch (150 mm) from joints of preceding layer.
- C. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
- D. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6.3 mm) with insulation.
- E. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- F. Cut and fit insulation within 1/4 inch (6.3 mm) of nailers, projections and penetrations.
- G. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water - **no ponding around roof drain or scuppers.**
- H. Do not apply more insulation than can be covered with membrane in same day.
- I. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints a minimum of 6 inches (150 mm) in each direction from joints of insulation below. Loosely butt cover boards together and fasten to roof deck.

3.06 MEMBRANE APPLICATION

- A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
- B. Shingle joints on sloped substrate in direction of drainage.
- C. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Apply adhesive to substrate at rate required by manufacturer. Fully embed membrane in adhesive except in areas directly over or within 3 inches (75 mm) of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

1. Do not apply to splice area of membrane roofing.
- E. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane. Lap sealant is not required on vertical splices.
 2. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
- F. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
- G. Around roof penetrations, seal flanges and flashings with flexible flashing.
- H. Coordinate installation of roof drains and related flashings.
- I. Install walkway pads around roof hatches and roof mounted equipment. Extend minimum of 3 feet (1 m) from roof hatch on three sides and 5 feet (1.5 m) from service access locations on roof mounted equipment. Install walkway pads from roof access locations to equipment to match existing.

3.07 FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of flashing sheet at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing as recommended by manufacturer.
- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Apply coatings to sheet roofing and flashings according to manufacturer's recommendations, by spray, roller, or other suitable application method.

3.08 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field quality control and inspection.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

3.09 CLEANING

- A. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.
- B. Repair or replace defaced or damaged finishes caused by work of this section.

3.10 PROTECTION

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Fabricated sheet metal items, including flashings, counterflashings, and other items indicated in Schedule.
- B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

- A. Section 07 72 00 - Roof Accessories: Manufactured metal roof curbs.

1.03 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
- D. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).
- E. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, roof details, roof edge trim, glazing trim and installation details.
 - 1. Include sheet gauge, texture and color selections.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

1.07 WARRANTY

- A. Sheet Metal Flashing and Trim Guarantee: Include metal roof flashing work with roofing guarantee.

PART 2 PRODUCTS**2.01 SHEET MATERIALS**

- A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239 inch) (0.61 mm) thick base metal.
- B. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239) inch (0.61 mm) thick base metal, shop pre-coated with PVDF coating.

1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
2. Color: As selected by SJCF from manufacturer's standard colors. Smooth clear anodized aluminum at MCM panels.
3. Gauges required, flat sheet, smooth for fabrication.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat.

2.02 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated.
- D. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.
- E. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.
- F. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.
- G. Holes, dents, creases or wrinkles shall be cause for rejection.

2.03 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Primer: Zinc chromate type.
- C. Concealed Sealants: Non-curing butyl sealant.
- D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- E. Plastic Cement: ASTM D4586/D4586M, Type I.

PART 3 EXECUTION

3.01 GENERAL

- A. Sheet metal flashing and trim assemblies as indicated 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.

3.02 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.03 INSTALLATION

- A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- B. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

- C. Seams: Joints butted with 6 inch (152 mm) long concealed splice plate. Apply bond breaker tape on splice plate minimum 1/2 inch (12.7 mm) wide. Space facing metal at least 3/8 inch (9.5 mm) apart over the tape. Apply sealant over joint.
- D. Seal metal joints watertight.
- E. Counter Flashing: Lap cap (counter) flashing joints 4 inch (102 mm), seal.
 - 1. Install cap (counter) flashing to spring tight against roofing, secure cap (counter) flashing in reglet. Stagger joints at least 12 inch (305 mm) from reglet joints.
- F. Reglets: Install formed metal in reglets where flashing is shown. Lap and seal joints.

END OF SECTION

SECTION 07 81 00 - APPLIED FIREPROOFING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Fireproofing of interior structural steel not exposed to damage or moisture.

1.02 RELATED REQUIREMENTS

- A. Section 01 45 33 - Code-Required Special Inspections.
- B. Section 05 12 00 - Structural Steel Framing.
- C. Section 05 21 00 - Steel Joist Framing.
- D. Section 05 31 00 - Steel Decking.
- E. Section 07 84 00 - Firestopping.

1.03 REFERENCE STANDARDS

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.
- B. ASTM E605/E605M - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993, with Editorial Revision (2015).
- C. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2017.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- E. ASTM E605 - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (Reapproved 2011).
- F. ASTM E736 - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2000 (Reapproved 2011).
- G. ASTM E759 - Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2011).
- H. ASTM E760/E760M - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2015)e1.
- I. ASTM E761 - Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2011).
- J. ASTM E859 - Standard Test Method for Air Erosion of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (Reapproved 2011).
- K. ASTM E937 - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (Reapproved 2011).
- L. UL (FRD) - Fire Resistance Directory; current edition.
- M. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with placement of ceiling hanger tabs, mechanical component hangers, and electrical components.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.

- B. Product Data: Provide data indicating product characteristics, performance criteria, and limitations of use.
- C. Shop Drawings: Plans indicating the following:
 - 1. Locations and types of surface preparations.
 - 2. Applicable fire-resistance design designations of a qualified testing and inspecting agency.
 - 3. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.
- D. Test Reports: Reports from reputable independent testing agencies for proposed products, indicating compliance with specified criteria, conducted under conditions similar to those on project, for:
 - 1. Bond strength.
 - 2. Bond impact.
 - 3. Compressive strength.
 - 4. Fire tests using substrate materials similar those on project.
- E. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.
- F. Manufacturer's Certificate: Certify that sprayed-on fireproofing products meet or exceed requirements of contract documents.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, and:
 - 1. Having minimum three years of experience.
 - 2. Approved by manufacturer.

1.07 FIELD CONDITIONS

- A. Do not apply spray fireproofing when temperature of substrate material and surrounding air is below 40 degrees F (4 degrees C) or when temperature is predicted to be below said temperature for 24 hours after application.
- B. Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.
- C. Provide temporary enclosure to prevent spray from contaminating air.
- D. Do not allow roof traffic during installation of roof fireproofing and drying period.
- E. Provide temporary enclosures for applications to prevent deterioration of fire-resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.
- F. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.
- G. Do not apply fire-resistive material to metal floor deck substrates until concrete topping has been completed. Do not apply fire-resistive material to metal roof deck substrates until roof has been completed.
- H. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.

- B. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.
- C. Store products under cover and elevated above grade.

1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
 - 1. Include coverage for fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering.
 - 2. Reinstall or repair failures that occur within warranty period.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sprayed-On Fireproofing:
 - 1. Isolatek International Corp; [Cafco Brand]: Blaze-Shield II. www.isolatek.com/#sle.
- B. Other acceptable Manufacturer's of Sprayed-On Fireproofing:
 - 1. Carbolite Company: www.carbolite.com.
 - 2. GCP Applied Technologies; Monokote: www.gcpat.com/fireproofing/#sle.
 - 3. Southwest Fireproofing Products Company: www.sfrm.com.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FIREPROOFING ASSEMBLIES

- A. Provide assemblies as indicated on the drawings and code plan.
- B. UL listings with a Load Restriction are not allowed.
- C. Fire-Resistance Design: Tested according to ASTM E119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Steel members are to be considered unrestrained unless specifically noted otherwise.

2.03 MATERIALS

- A. Source Limitations: Obtain Applied Fireproofing through one source from a single manufacturer.
- B. Provide products containing no detectable asbestos.
Reference the Schedule at the end of this Section for location and properties.
- C. Sprayed Fire-Resistive Material for Interior Applications: Manufacturer's standard factory mixed material, which when combined with water is capable of providing the indicated fire resistance, and conforming to the following requirements:
 - 1. Composition: Portland-cement-based, not mineral fiber-based.
 - 2. Bond Strength and Dry Density: See schedule below.
 - 3. Effect of Impact on Bonding: No cracking, spalling or delamination, when tested in accordance with ASTM E760.
 - 4. Corrosivity: No evidence of corrosion, when tested in accordance with ASTM E937.
 - 5. Air Erosion Resistance: Weight loss of 0.025 g/sq ft (0.27 g/sq m), maximum, when tested in accordance with ASTM E859 after 24 hours.
 - 6. Surface Burning Characteristics: Maximum flame spread index of 0 (zero) and maximum smoke developed index of 0 (zero), when tested in accordance with ASTM E84.
 - 7. Effect of Deflection: No cracking, spalling, or delamination, when tested in accordance with ASTM E759.

2.04 ACCESSORIES

- A. Primer Adhesive: Of type recommended by fireproofing manufacturer.
- B. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required to comply with fire-resistance designs indicated and fire-resistive material manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive sprayed fire-resistive material.
- C. Water: Clean, potable.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that surfaces are ready to receive fireproofing.
 - 1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, incompatible paints, incompatible encapsulants, or other foreign substances capable of impairing bond of fire-resistive materials with substrates under conditions of normal use or fire exposure.
- B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.
- C. Verify that ducts, piping, equipment, or other items that would interfere with application of fireproofing have not been installed.
- D. Verify that voids and cracks in substrate have been filled. Verify that projections have been removed where fireproofing will be exposed to view as a finish material.
- E. Verify that projections have been removed where fireproofing will be exposed to view as a finish material.
- F. Verify that concrete work on steel deck has been completed.
- G. For steel, sheet metal ducts, decking and other substrates suspected of being coated with oil, rolling compounds or other substances not readily identifiable but potentially capable of impairing bond, conduct tests recommended by fireproofing manufacturer to determine their presence and effect on adhesion of fireproofing.
- H. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Perform tests as recommended by fireproofing manufacturer in situations where adhesion of fireproofing to substrate is in question.
- B. Remove incompatible materials that could affect bond by scraping, brushing, scrubbing, or sandblasting.
- C. Prepare substrates to receive fireproofing in strict accordance with instructions of fireproofing manufacturer.
- D. Prime substrates where recommended in writing by sprayed fire-resistive material manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive sprayed fire-resistive material.
- E. Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.
- F. Close off and seal duct work in areas where fireproofing is being applied.

3.03 APPLICATION

- A. Comply with fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and

spray on fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

- B. Coat substrates with bonding adhesive before applying fire-resistive material where required to achieve fire-resistance rating or as recommended in writing by sprayed fire-resistive material manufacturer for material and application indicated.
- C. Apply fireproofing in thickness and density necessary to achieve required ratings, with uniform density and texture.
- D. In exposed locations, trowel surface smooth and form square edges, using tools and procedures recommended by fireproofing manufacturer.
- E. Spray apply fire-resistive materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by sprayed fire-resistive material manufacturer.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect the installed fireproofing after application and curing for integrity, prior to its concealment. Ensure that actual thicknesses, densities, and bond strengths meet requirements for specified ratings and requirements of the Authority Having Jurisdiction.
- C. Ensure that actual thicknesses, densities, and bond strengths meet requirements for specified ratings and requirements of authorities having jurisdiction (AHJ).
- D. Remove and replace installed fireproofing that does not comply with specified requirements, as directed by SJCF.
- E. Reference 01 45 33 - Code-Required Special Inspections for testing procedures.
- F. Re-inspect the installed fireproofing for integrity of fire protection, after installation of subsequent Work.

3.05 CLEANING

- A. Immediately upon completion of spraying operations in each containable area of project, remove excess material, overspray, droppings, and debris.
- B. Remove fireproofing from materials and surfaces not required to be fireproofed.
- C. At exposed fireproofing, clean surfaces that have become soiled or stained, using manufacturer's recommended procedures.

3.06 PROTECTION

- A. Protect fireproofing according to advice of fireproofing manufacturer and Installer from damage resulting from construction operations or other causes so that fireproofing will be without damage or deterioration at time of Substantial Completion.

3.07 SCHEDULE

- A. At interior, concealed locations provide: Sprayed Fire-Resistive Material with a Dry Density of 15 lb/cu ft (240 kg/cu m) when tested accordance to ASTM E605/E605M and a Bond Strength of 150 psf (7.2 kPa) minimum, when tested in accordance with ASTM E736/E736M when set and dry.

END OF SECTION

SECTION 07 81 23 - INTUMESCENT MASTIC FIREPROOFING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Thin-film intumescent fire resistive coatings for exposed structural steel.
- B. Protective and/or decorative topcoats.

1.02 RELATED REQUIREMENTS

- A. Section 05 12 00 - Structural Steel Framing.
- B. Section 09 91 23 - Interior Painting: Field-applied paints matching intumescent fireproofing.

1.03 REFERENCE STANDARDS

- A. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2005 (Reapproved 2010).
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- C. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.
- D. SSPC-PA 2 - Procedure For Determining Conformance To Dry Coating Thickness Requirements; 2015.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Performance characteristics and test results.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods.
- C. Selection Samples: For decorative top coat, color chips representing manufacturer's full range of available colors and sheens.
- D. Verification Samples: For each thickness, color, sheen, and finish required, samples not less than 4 inches (100 mm) square on steel substrate, illustrating finished appearance.
- E. Test Reports: Published fire resistive designs for structural elements of the types required for the project, indicating hourly ratings of each assembly.
- F. Certificates: Certify that intumescent fireproofing provided for this project meets or exceeds specified requirements in all respects.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company that specializes in manufacturing the type of products specified, with minimum of 10 years of documented experience.
- B. Installer Qualifications: Approved, certified, or supervised by manufacturer of intumescent fireproofing, with not less than 5 years of documented experience.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship. Approved mock-up will serve as a standard of comparison for subsequent work of this section.
 - 1. Finish at least 10 sq ft (1 sq m) of steel in areas designated by SJCF.
 - 2. Evaluate mock-up for compliance with specified requirements, including thickness and finish texture.

3. Do not proceed with remaining work until workmanship, color, and sheen are approved by SJCF.
4. Refinish mock-up area as required to produce acceptable work.
5. Approved mock-up may remain as part of the project.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original, unopened containers with identification labels and testing agency markings intact and legible.
- B. Store products in manufacturer's unopened packaging until ready for installation.
 1. Store at temperatures not less than 50 degrees F (10 degrees C) in dry, protected area.
 2. Protect from freezing, and do not store in direct sunlight.
 3. Dispose of any materials that have come into contact with contaminants of any kind prior to application.
- C. Dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

- A. Protect areas of application from windblown dust and rain.
- B. Maintain ambient field conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under ambient conditions outside manufacturer's absolute limits.
 1. Provide temporary enclosures as required to control ambient conditions.
 2. Do not apply intumescent fireproofing when ambient temperatures are below 50 degrees F (10 degrees C) without specific approval from manufacturer.
 3. Maintain relative humidity between 40 and 60 percent in areas of application.
 4. Maintain ventilation in enclosed spaces during application and for not less than 72 hours afterward.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.
 1. Include coverage for intumescent mastic fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering.
 2. Reinstall or repair failures that occur within warranty period.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Intumescent Fireproofing:
 1. Albi Manufacturing Division of StanChem Inc; Product Albi Clad TF and color coat topcoat: www.albi.com.
 2. Carboline Company; A/D Firefilm III and color coat topcoat: www.carboline.com.
 3. Isolatek International Corp; CAFCO SprayFilm WB 5 (interior): www.isolatek.com/#sle.
 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SYSTEM REQUIREMENTS

- A. Fireproofing: Provide intumescent thin-film fire resistive coating systems tested by an independent testing agency in accordance with ASTM E119 and acceptable to authorities having jurisdiction (AHJ).
 1. Provide assemblies listed by UL or FM and bearing listing agency label or mark.

2.03 MATERIALS

- A. Fire Resistant Coating System: Thin film intumescent coating system for the fire protection of structural steel.
 - 1. Surface Burning Characteristics: Tested in accordance with ASTM E84.
 - a. Flame Spread Index (FSI): 25, maximum.
 - b. Smoke Developed Index (SDI): 50, maximum.
 - 2. For Interior Use:
 - a. Hardness: 50, minimum, when tested in accordance with ASTM D2240, Type D durometer.
- B. Protective and Decorative Top Coating: As recommended by fireproofing manufacturer for exposure conditions.
 - 1. Coordinate with paint specified in Section 09 91 23 for color and sheen match between steel coated with intumescent coating and adjacent painted surfaces.
- C. Primer: As required by tested and listed assemblies, and as recommended by fireproofing manufacturer to suit specific substrate conditions.
- D. Reinforcement: Glass fiber fabric matching type used in tested and listed assemblies.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates to determine if they are in satisfactory condition to receive intumescent fireproofing. Verify that they are clean and free of oil, grease, incompatible primers, or other foreign substances capable of impairing bond to fireproofing system.
- B. Do not begin installation until substrates have been properly prepared.
- C. Do not begin installation until substrates have been properly prepared. If substrate preparation is the responsibility of another installer, notify SJCF of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Thoroughly clean surfaces to receive fireproofing.
- B. Repair substrates to remove surface imperfections that could affect uniformity of texture and thickness of fireproofing system. Remove minor projections and fill voids that could telegraph through the finished work.
- C. Cover or otherwise protect other work that might be damaged by fallout or overspray of fireproofing system. Provide temporary enclosures as necessary to confine operations and maintain required ambient field conditions.

3.03 INSTALLATION

- A. Comply with manufacturer's instructions for particular conditions of installation in each case.
- B. Apply manufacturer's recommended primer to required coating thickness.
- C. Apply fireproofing to full thickness over entire area of each substrate to be protected.
- D. Apply fireproofing to full thickness over entire area of each substrate to be protected. Apply coats at manufacturer's recommended rate to achieve dry film thickness required for fire resistance ratings designated for each condition.
- E. Apply intumescent fireproofing by spraying to maximum extent possible. If necessary, complete coverage by roller application or other method acceptable to manufacturer.
- F. Achieve uniform finished appearance complying with approved mock-up.

3.04 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 40 00 - Quality Requirements.
 - 1. Arrange for testing of installed intumescent fireproofing by an independent testing laboratory using magnetic thickness gage, in accordance with SSPC-PA 2.
 - 2. Submit test reports promptly to Contractor and SJCF.
- B. Repair or replace fireproofing at locations where test results indicate fireproofing does not meet specified requirements.

3.05 CLEANING

- A. Immediately after installation of fireproofing in each area, remove overspray and fallout from other surfaces and clean soiled areas.

3.06 PROTECTION

- A. Protect installed intumescent fireproofing from damage due to subsequent construction activities, so fireproofing is without damage or deterioration before Date of Substantial Completion.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 07 84 00 - FIRESTOPPING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Firestopping systems.
- B. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.
- B. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2013a.
- C. ASTM E1966 - Standard Test Method for Fire Resistive Joint Systems; 2007 (Reapproved 2011).
- D. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2015a.
- E. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2013.
- F. ITS (DIR) - Directory of Listed Products; current edition.
- G. FM (AG) - FM Approval Guide; current edition.
- H. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.
- I. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.
- J. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- E. Installer Qualification: Submit qualification statements for installing mechanics.

1.05 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
 - 1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.

- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and:
 - 1. Verification of minimum three years experience installing work of this type.
 - 2. Verification of at least five satisfactorily completed projects of comparable size and type.

1.06 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Firestopping Manufacturers:
 - 1. 3M Fire Protection Products: www.3m.com/firestop.
 - 2. A/D Fire Protection Systems Inc: www.adfire.com.
 - 3. Hilti, Inc: www.us.hilti.com/#sle.
 - 4. Nelson FireStop Products: www.nelsonfirestop.com.
 - 5. Specified Technologies Inc: www.stifirestop.com/#sle.
 - 6. Nuco Inc.: www.nucoinc.com.
 - 7. Tremco Inc.: www.tremcosealants.com.
 - 8. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

- A. Firestopping Materials: Any materials meeting requirements.
- B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- C. Fire Ratings: See Code Plan and Drawings for required systems and ratings.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Perimeter Fire Containment Firestopping: Use any system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of the floor assembly.
 - 1. Where floor assembly is not required to have a fire rating, provide systems that have been tested to show L Rating as indicated.
- B. Head-of-Wall Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use any system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.
- C. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use any system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
- D. Through Penetration Firestopping: Use any system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

2.04 FIRESTOPPING SYSTEMS

- A. Firestopping: Any material meeting requirements.
- B. Fire Ratings: Use any system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.
- C. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to arrest liquid material leakage.

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.
- D. Each trade is responsible for sizing and locating block-outs and the like for penetrations through construction. If such information is not furnished in a timely manner the trade shall be responsible for the cutting of required openings.
- E. Correlate sizes of openings shown on construction documents and verify their accuracy for the specific system or item(s) accommodated by them.
- F. Each trade whose work penetrates a fire-rated element shall seal the opening to assure fire and smoke stop meeting the fire rating.
- G. Extra, abandoned and oversize openings shall all be sealed. Where openings are abandoned they shall be filled with construction matching the adjacent work unless the area is protected by a permanent barrier preventing loading or traffic on the firestopped area.

3.04 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

3.06 SCHEDULE

- A. Duct, cables, conduit, and piping penetrations through time-rated floor, roof, walls.
- B. Openings between floor slabs and curtain walls, including inside hollow curtain walls at the floor slab.
- C. Penetrations of vertical service shafts.

- D. Top of wall and deck intersections of time-rated walls.
- E. Wall opening protective materials for outlet boxes in the same stud cavity or within 24 inch (610 mm) of each other in time-rated walls.
- F. Openings for cable trays in time-rated walls.
- G. Joints:
 - 1. Joints in smoke barriers.
 - 2. Joints in exterior curtain-wall/floor intersections.
 - 3. Joints in or between fire-resistance-rated construction.
- H. Openings and penetrations in enclosures where time-rated opening protection is required.
- I. Other locations where specifically shown on the drawings or where called for in other sections of the specification.

END OF SECTION

SECTION 07 92 00 - JOINT SEALANTS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.
- D. Owner-provided field quality control.

1.02 RELATED REQUIREMENTS

- A. Section 07 25 00 - Weather Barriers: Sealants required in conjunction with air barriers and vapor retarders.
- B. Section 07 84 00 - Firestopping: Firestopping sealants.
- C. Section 08 71 00 - Door Hardware: Setting exterior door thresholds in sealant.
- D. Section 08 80 00 - Glazing: Glazing sealants and accessories.
- E. Section 09 21 16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

1.03 REFERENCE STANDARDS

- A. ASTM C834 - Standard Specification for Latex Sealants; 2014.
- B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.
- E. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2008 (Reapproved 2012).
- F. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2014.
- G. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2002 (Reapproved 2013).
- H. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2013.
- I. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
 - 5. Substrates for which use of primer is required.
 - 6. Installation instructions, including precautions, limitations, and recommended backing materials and tools.

- C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- D. Installation Plan: Submit at least four weeks prior to start of installation.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of experience.
- C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.
- D. Installation Plan: Include schedule of sealed joints, including the following.
 - 1. Joint width indicated in contract documents.
 - 2. Joint depth indicated in contract documents; to face of backing material at centerline of joint.
 - 3. Method to be used to protect adjacent surfaces from sealant droppings and smears, with acknowledgement that some surfaces cannot be cleaned to like-new condition and therefore prevention is imperative.
- E. Contractor shall employ independent testing agency.
- F. Field Quality Control Plan:
 - 1. Visual inspection of entire length of sealant joints.
 - 2. Non-destructive field adhesion testing of sealant joints, except interior acrylic latex sealants.
 - a. For each different sealant and substrate combination, allow for one test every 12 inches (305 mm) in the first 10 linear feet (3 linear meters) of joint and one test every 24 inches (610 mm) thereafter.
 - b. If any failures occur in the first 10 linear feet (3 linear meters), continue testing at 12 inch (305 mm) intervals at no extra cost to Owner.
 - 3. Field testing agency's qualifications.
 - 4. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.
- G. Field Adhesion Test Procedures:
 - 1. Allow sealants to fully cure as recommended by manufacturer before testing.
 - 2. Have a copy of the test method document available during tests.
 - 3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
 - 4. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to SJCF.
- H. Non-Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.
 - 1. Record results on Field Quality Control Log.
 - 2. Repair failed portions of joints.

1.06 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.

2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a two year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
 1. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 2. Bostik Inc: www.bostik-us.com.
 3. Dow Corning Corporation: www.dowcorning.com/construction/sle.
 4. Hilti, Inc: www.us.hilti.com/#sle.
 5. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com/sle.
 6. Pecora Corporation: www.pecora.com.
 7. Tremco Global Sealants: www.tremcosealants.com.
 8. Sika Corporation: www.usa-sika.com.
 9. W.R. Meadows, Inc: www.wrmeadows.com/sle.
 10. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
 1. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 2. Bostik Inc: www.bostik-us.com.
 3. Dayton Superior Corporation: www.daytonsuperior.com.
 4. Dow Corning Corporation: www.dowcorning.com/construction/sle.
 5. Pecora Corporation: www.pecora.com.
 6. Tremco Global Sealants: www.tremcosealants.com.
 7. Sika Corporation: www.usa-sika.com.
 8. W.R. Meadows, Inc: www.wrmeadows.com/sle.
 9. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

- A. Scope:
 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Openings below ledge angles in masonry.
 - e. Joints between precast panels, adjacent materials.
 - f. Other joints indicated below.

2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
 - 1) Exception: Through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
 - c. Joints between dissimilar materials; such as between tile and hollow metal frames.
 - d. Other joints indicated below.
3. Do not seal the following types of joints.
 - a. Intentional weepholes in masonry.
 - b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
 - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - d. Joints where installation of sealant is specified in another section.
 - e. Joints between suspended panel ceilings/grid and walls.

B. Type of Joint

Designations: The number Type refer to the product to be used, listed in Sealants below.

1. Exterior Joints:
 - a. Perimeters of exterior opening frames at adjoining materials:
Type: 3, 4, 5.
 - b. Expansion and control joints in exterior surfaces of poured-in-place concrete, masonry, precast concrete and architectural precast concrete:
Type: 3, 4, 5, Preformed Joint Seals.
 - c. Perimeter joints in EIFS soffits.
Type: 3, 4, 5.
 - d. Coping joints and coping-to-facade joints.
Type: 3, 4, 5.
 - e. Metal flashing trim joints.
Type: 3, 4, 5.
 - f. Cornice and wash (or horizontal surface joints).
Type: 3, 4, 5.
 - g. Exterior joints in horizontal wearing surfaces - vehicle, pedestrian paving and paving to building joints.
Type: 8.
 - h. Control and expansion joints open or soft joints in masonry under steel support members on the interior of exterior poured-in-place concrete.
Type: 3, 4, 5.
 - i. One inch 1 inch (25.4 mm) expansion joints shall be two part non-sag at vertical joints.
Type: 3, 5.
 - j. One inch 1 inch (25.4 mm) expansion joints shall be two part self-leveling at horizontal joints.
Type: 8.
 - k. Expansion joints larger than 1 inch (25.4 mm).
Type: Preformed Joints Seals.
2. Interior Joints:
 - a. Seal interior perimeters of exterior opening frames.

- Type: 3, 4, 5, 7.
- b. Control and expansion joints open or soft joints in masonry under steel support members on the interior of exterior poured-in-place concrete.
Type: 3, 4, 5.
- c. Control and expansion joints on the interior of exterior surfaces of exposed unit masonry walls and architectural wall panels.
Type: 3, 4, 5.
- d. Interior control and expansion joints in floor surfaces.
Type: 8, 9, Preformed Joint Seals.
- e. Perimeters of interior frames in masonry walls.
Type: 3, 4, 5.
- f. Interior at floor/wall intersection of brick or burnished block and resilient flooring where there is no applied base.
Type: 4, 5.
- g. Interior masonry vertical control joints and intersections of masonry and other walls.
Type: 3, 4, 5.
- h. Joints at tops of non-load bearing masonry walls at the underside of construction above.
Type: 5, 7, 8.
- i. Perimeter of plumbing fixtures where they abut walls, counters and floors.
Type: 3.
- j. Joints of counters and backsplashes where they abut walls.
Type: 3, 7.
- k. Joints where gypsum board partitions abut walls and floors of same or dissimilar materials.
Type: 3, 4, 5.
- l. Joints where gypsum board ceilings abut masonry walls. Where liquid tile finish is used, caulk joints after liquid tile is in place using color to match painted finish.
Type: 3, 4, 5.
- m. One inch 1 inch (25.4 mm) expansion joints shall be two part non-sag at vertical joints.
Type: 4, 5.
- n. One inch 1 inch (25.4 mm) expansion joints shall be two part self-leveling at horizontal joints.
Type: 8.
- C. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

2.03 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.
- B. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177-2600.
- C. As selected by Architect from manufacturer's standard colors. In general, colors will be selected to match or be slightly darker than the adjacent material(s).

2.04 NONSAG JOINT SEALANTS

Designations: The number Type refer to the work to be caulked in Joint Sealant Applications above.

- A. Type 1 - Acoustical Sealant:

1. Specified in Section 09 21 16 - Gypsum Board Assemblies.
- B. Type 2 - Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
 1. Movement Capability: Plus and minus 50 percent, minimum.
 2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
 3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
 4. Manufacturers:
 - a. Dow Corning Corporation; 790 Silicone Building Sealant: www.dowcorning.com/construction/#sle.
 - b. Pecora Corporation; 864NST Low Modulus Architectural Silicone Sealant: www.pecora.com.
 - c. Momentive Performance Materials, Inc (GE Silicones products); SCS2700 Silpruf LM: www.momentive.com.
 - d. Tremco Global Sealants; Spectrem 3: www.tremcosealants.com.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Type 3 - Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
 1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Manufacturers:
 - a. Dow Corning Corporation; 791: www.dowcorning.com/construction/sle.
 - b. Pecora Corporation; 860: www.pecora.com.
 - c. Momentive Performance Materials, Inc (GE Silicones products); SCS2800 Silglaze II: www.momentive.com.
 - d. Tremco Global Sealants; Spectrem 2: www.tremcosealants.com.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Type 4 - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
 1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Color: To be selected by SJCF from manufacturer's standard range.
 3. Manufacturers:
 - a. Pecora Corporation; DynaTrol II General Purpose Two Part Polyurethane Sealant: www.pecora.com.
 - b. Sika Corporation; Sikaflex-2c NS: www.usa-sika.com/#sle.
 - c. W. R. Meadows, Inc; POURTHANE NS: www.wrmeadows.com/#sle.
 - d. Tremco Building Solutions; Dymeric 240FC: www.tremcosealants.com.
 - e. MasterSeal; NP2: www.master-builders-solutions.basf.com.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Type 5 - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
 1. Movement Capability: Plus and minus 25 percent.
 2. Color: To be selected by SJCF from manufacturer's standard range.
 3. Products:
 - a. Pecora Corporation; DynaTrol I-XL General Purpose One Part Polyurethane Sealant: www.pecora.com.
 - b. MasterSeal; NP1: www.master-builders-solutions.basf.com.
 - c. Tremco Building Solutions; Dymonic FC: www.tremcosealants.com.
 - d. Sika Corp.; Sikaflex 1A: www.sikacorp.com.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.

- F. Type 7 - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
 - 1. Color: To be selected by SJCF from manufacturer's standard range.
 - 2. Manufacturers:
 - a. Pecora Corporation; AC-20 + Silicone Acrylic Latex Caulking Compound: www.pecora.com.
 - b. Tremco Global Sealants; Tremflex 834: www.tremcosealants.com.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 SELF-LEVELING SEALANTS

- A. Type 8 - Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Manufacturers:
 - a. Pecora Corporation; NR-200 Self-Leveling Traffic-Grade Polyurethane Sealant: www.pecora.com.
 - b. Sherwin-Williams Company; Stampede 2SL Polyurethane Sealant: www.sherwin-williams.com/#sle.
 - c. Sika Corporation; Sikaflex-2c SL: www.usa-sika.com/#sle.
 - d. MasterSeal; SL2: www.master-builders-solutions.basf.com.
 - e. Tremco Global Sealants; THC-900: www.tremcosealants.com.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Type 9 - Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion.
 - 1. Movement Capability: Plus and minus 25 percent.
 - 2. Manufacturers:
 - a. Sherwin-Williams Company; Stampede 2SL Polyurethane Sealant: www.sherwin-williams.com.
 - b. Pecora Corporation; Unexpan NR-201: www.pecora.com.
 - c. MasterSeal; SL1: www.master-builders-solutions.basf.com.
 - d. Sika Corp.; Sikaflex 1CSL: www.sikacorp.com.
 - e. Tremco Global Sealants; Vulkem 45 SSL: www.tremcosealants.com.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
 - 1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type C - Closed Cell Polyethylene.
 - 2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type C - Closed Cell Polyethylene.
 - 3. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- D. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Perform acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 FIELD QUALITY CONTROL

- A. Owner may employ an independent testing agency to perform field quality control inspection and testing as specified in PART 1 under QUALITY ASSURANCE article.
 - 1. Independent testing may be employed by Owner if Owner has concerns over the quality of installation of exterior joints.
- B. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet (30 linear m), notify SJCF immediately.
- C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

3.05 POST-OCCUPANCY

- A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at the low temperature in the thermal cycle. Report failures immediately and repair.

END OF SECTION

SECTION 07 95 13 - EXPANSION JOINT COVER ASSEMBLIES**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Expansion joint cover assemblies for floor and wall surfaces.

1.02 RELATED REQUIREMENTS

- A. Section 03 10 00 - Concrete Forming and Accessories: Placement of joint cover assembly frames in formwork.
- B. Section 04 20 00 - Unit Masonry: Placement of joint cover assembly frames in masonry.
- C. Section 07 92 00 - Joint Sealants: Sealing expansion and control joints using gunnable and pourable sealants.
- D. Section 09 21 16 - Gypsum Board Assemblies: Placement of expansion joint assemblies in gypsum board walls and ceilings.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.
- D. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2010.
- E. ITS (DIR) - Directory of Listed Products; current edition.
- F. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices.
- C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction and anchorage locations.
- D. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Expansion Joint Cover Assemblies:
 - 1. Architectural Art Mfg, Inc: www.archart.com.
 - 2. Construction Specialties, Inc: www.c-sgroup.com.
 - 3. Inpro: www.inprocorp.com.
 - 4. MM Systems Corp: www.mmsystemscorp.com.
 - 5. Nystrom, Inc: www.nystrom.com/sle.
 - 6. Balco, Inc.: www.balcousa.com.
 - 7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 EXPANSION JOINT COVER ASSEMBLY APPLICATIONS

Basis of design is listed below. For each system, provide expansion control system and fire-barrier assembly with a rating not less than that of the adjacent construction. Width as required.

- A. Interior Floor Joints Subject to Thermal Movement at resilient floor finish at construction joints:
 - 1. Manufacturers:
 - a. Architectural Art Mfg. Inc.; 4 x 1/8 inch (102 x 3 mm) flat plate between flooring.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Interior Floor Joints Subject to Thermal Movement at carpet and carpet tile for expansion joints larger than 1 inch (25.4 mm):
 - 1. Manufacturers:
 - a. Architectural Art Mfg. Inc.; C10-14-41 floor to floor, C10-35-41 floor to wall.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Interior Floor Joints Subject to Thermal Movement at stage wood floor and concrete:
 - 1. Manufacturers:
 - a. Balco Inc.; 1120/1420 Series. Recessed at concrete floor, flush at wood floor..
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Interior Wall/Ceiling Joints Subject to Thermal Movement at masonry or concrete: For expansion joints larger than 1 inch (25.4 mm)
 - 1. Manufacturers:
 - a. Architectural Art Mfg. Inc.; G10-59-14 at wall, G10-69-14 at corner. Snap on, no exposed fasteners, with vinyl wearing pads.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Interior Wall/Ceiling Joints Subject to Thermal Movement at gypsum board:
 - 1. Manufacturers:
 - a. Architectural Art Mfg. Inc.; G10-59-14 at wall, G10-69-14 at corner. Snap on, no exposed fasteners, with vinyl wearing pads.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Interior Ceiling Joints Subject to Thermal Movement at acoustical ceiling: For expansion joints 1 inch (25.4 mm) and less.
 - 1. Manufacturers:
 - a. None required..
- G. Exterior Wall Expansion Joints Subject to Thermal Movement:
 - 1. Manufacturers:
 - a. Reference Section 07 90 05 Joint Sealers.

2.03 EXPANSION JOINT COVER ASSEMBLIES

- A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
 - 1. Joint Dimensions and Configurations: As indicated on drawings.
 - 2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
 - 3. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
 - 4. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.
- B. Floor Joint Covers: Coordinate with indicated floor coverings.
 - 1. If floor covering is not indicated, obtain instructions from SJCF before proceeding.

- C. Covers In Fire Rated Assemblies: Provide cover assembly having fire rating equivalent to that of assembly into which it is installed.
 - 1. Acceptable Evaluation Agencies: UL (DIR) and ITS (DIR).

2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.
 - 1. Exposed Finish at Floors: Mill finish or natural anodized.
 - 2. Exposed Finish at Walls and Ceilings: Natural anodized.
- B. Anchors and Fasteners: As recommended by cover manufacturer.
- C. Ferrous Metal Anchors: Galvanized where embedded in concrete or in contact with cementitious materials.
- D. Threaded Fasteners: Aluminum.
- E. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphaltic type.

2.05 PERFORMANCE REQUIREMENTS

- A. Accessibility Requirements: Comply with applicable provisions in the ADA Standards and ICC A117.1.
- B. Fire-Resistance Ratings: Where indicated, provide expansion control systems with fire barriers identical to those of systems tested for fire resistance per UL 2079 or ASTM E1966 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Hose Stream Test: Wall-to-wall and wall-to-ceiling assemblies shall be subjected to hose stream testing.

2.06 FABRICATION

- A. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where expansion control systems change direction or abut other materials.
- B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion control systems.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.
- B. Verify that frames and anchors installed by others are in correct locations and suitable for installation of remainder of assembly.

3.02 INSTALLATION

- A. Install components and accessories in accordance with manufacturer's instructions.
- B. Align work plumb and level, flush with adjacent surfaces.
- C. Rigidly anchor to substrate to prevent misalignment.
- D. Fire-Resistance-Rated Assemblies: Coordinate installation of architectural joint assembly materials and associated work so complete assemblies comply with assembly performance requirements.
 - 1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

3.03 PROTECTION

- A. Do not permit traffic over unprotected floor joint surfaces.
- B. Provide strippable coating to protect finish surface.

END OF SECTION

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.
- D. Thermally insulated hollow metal doors with frames.
- E. Security resistant hollow metal doors and frames.
- F. Detention security hollow metal doors and frames.
- G. Bullet resistant hollow metal doors and frames.
- H. Hollow metal borrowed lites glazing frames.

1.02 RELATED REQUIREMENTS

- A. Section 08 71 00 - Door Hardware.
- B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.
- C. Section 09 91 13 - Exterior Painting: Field painting.
- D. Section 09 91 23 - Interior Painting: Field painting.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.
- G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2014.
- H. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
- I. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.
- J. FEMA P-361 - Safe Rooms for Tornadoes and Hurricanes: Guidance for Community and Residential Safe Rooms; 2015.
- K. ICC 500 - ICC/NSSA Standard for the Design and Construction of Storm Shelters; National Storm Shelter Association; 2014.
- L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.
- M. ITS (DIR) - Directory of Listed Products; current edition.

- N. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
- O. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
- P. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.
- Q. NAAMM HMMA 850 - Fire-Protection and Smoke Control Rated Hollow Metal Door and Frame Products; 2014.
- R. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2006.
- S. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- T. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2016.
- U. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.
- V. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.
- W. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.
- X. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- Y. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- Z. UL 752 - Standard for Bullet-Resisting Equipment; Current Edition, Including All Revisions.
- AA. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
 - 1. Finish hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
 - 1. Provide a schedule of hollow metal work using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule. Include fire rating locations.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.
- C. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- D. Store hollow metal work under cover at Project site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Ceco Door; Curries, an Assa Abloy Group company: www.assaabloydss.com.
 - 2. Republic Doors: www.republicdoor.com.
 - 3. Steelcraft, an Allegion brand: www.allegion.com/#sle.
 - 4. Amweld Building Products, LLC: www.amweld.com.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Security and Bullet Resistant Hollow Metal Doors and Frames (hinged):
 - 1. Ceco Door, an Assa Abloy Group Company; ArmorShield
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DESIGN CRITERIA

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel used for fabrication of doors and frames shall comply with one or more of the following requirements; Galvannealed steel conforming to ASTM A653/A653M, cold-rolled steel conforming to ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel conforming to ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.
 - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 3. Edge and Face Sheet Joining: Mechanically interlocked vertical edges, continuous weld, welds are to be ground and filled to make them invisible and provide a smooth flush surface.
 - 4. Door Top and Bottom Closures: Flush with top/bottom of faces and edges.
 - a. Continuous steel channel not less than 16 gage, extending the full width of the door and welded to the face sheet.
 - 5. Door Edge Profile: Beveled on latch edge.
 - a. Edge shall be beveled 1/8 inch in 2 inches (3.1 mm in 50.8 mm).
 - 6. Typical Door Face Sheets: Flush.
 - 7. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
 - a. Form corners of stops with butted hairline joints.
 - 8. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
 - a. Doors shall be mortised for hinges. Hinge reinforcements shall be 7 gage steel, drilled and tapped.
 - b. Frames shall be mortised for hinges. Hinge reinforcement shall be 7 gage steel, drilled and tapped. Where surface mounted hardware is to be applied, frames shall have 12 gage reinforcing plates only. Lock jambs shall be mortised for a universal lock strike. Plaster guards shall be provided.
 - 9. Astragals as required on fire rated door; pairs and flush transom.
 - a. Provide pairs of doors without astragal at doors rated to 1½ hour with automatic flush bolts.
 - 10. Zinc Coating for Typical Interior and/or Exterior Locations as indicated below: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.

- a. Based on SDI Standards: Provide at least A60/ZF180 (galvannealed) for corrosive, wet (locker rooms and showers) and exterior door locations.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.
- C. Security and Bullet Resistant Hollow Metal Doors & Frames shall comply with Level 4 (UL 752).

2.03 HOLLOW METAL DOORS

- A. Door Finish: Factory primed and field finished.
- B. Exterior Doors: Thermally insulated.
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 4 - Maximum-duty.
 - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 2 - Seamless.
 - d. Door Face Metal Thickness: 14 gage, 0.067 inch (1.7 mm), minimum.
 - e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
 - 2. Core Material: Manufacturers standard core material/construction and in compliance with requirements.
 - 3. Door Thermal Resistance: R-Value of 6.35.
 - 4. Door Thickness: 1-3/4 inch (44.5 mm), nominal.
 - 5. Top Closures: Flush with top of faces and edges.
 - 6. Weatherstripping: Refer to Section 08 71 00.
- C. Interior Doors, Non-Fire Rated:
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 3 - Extra Heavy-duty.
 - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 2 - Seamless.
 - d. Door Face Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
 - 2. Core Material: One piece honeycomb bonded to both faces.
 - 3. Door Thickness: 1-3/4 inch (44.5 mm), nominal.
 - 4. Top Closures : Flush with top of faces and edges.
- D. Fire-Rated Doors:
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 3 - Extra Heavy-duty.
 - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 2 - Seamless.
 - d. Door Face Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
 - e. Zinc Coating for exterior doors: A60/ZF180 galvannealed coating; ASTM A653/A653M.
 - 2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
 - a. Provide units listed and labeled by UL (DIR) or ITS (DIR).
 - b. Attach fire rating label to each fire rated unit.
 - c. Smoke and Draft Control Doors: Self-closing or automatic closing doors in accordance with NFPA 80 and NFPA 105, with fire-resistance-rated wall

construction rated the same or greater than the fire-rated doors, and the following;

- 1) Maximum Air Leakage: 3.0 cfm/sq ft (0.02 cu m/sec/sq m) of door opening at 0.10 inch w.g. (24.9 Pa) pressure, when tested in accordance with UL 1784 at both ambient and elevated temperatures.
- 2) Gasketing: Provide gasketing or edge sealing as necessary to achieve leakage limit.
- 3) Label: Include the "S" label on fire-rating label of door.
3. Core Material: Manufacturers standard core material/construction in compliance with requirements.
4. Door Thickness: 1-3/4 inch (44.5 mm), nominal.
5. Top Closures : Flush with top of faces and edges.
- E. Type BRF, Security Resistant Interior Doors (hinged):
 1. Ballistic Resistance: UL 752, Threat Level Rating - Level 4.
 2. Core Material: Manufacturers standard core material/construction and in compliance with requirements..
 3. Door Thickness: As required to meet requirements indicated.
 4. Hinge Rail and Reinforcement: Non-beveled edge, reinforced with continuous steel channel, 12 gage, 0.093 inch (2.3 mm) minimum metal thickness, welded at 5 inch (127 mm) on center maximum, and compatible with 4-1/2 inch (114 mm) full mortise template and continuous geared hinges.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. Corners: Head and jamb members shall have diecut mitered corners that interlock rigidly prior to welding. All welds ground smooth and primed.
- D. Exterior Door Frames: Face welded type.
 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A60/ZF180 coating.
 2. Frame Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
 3. Weatherstripping: Separate, see Section 08 71 00.
- E. Interior Door Frames, Non-Fire-Rated: Fully welded type, seamless with joints filled.
 1. Frame Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
- F. Door Frames, Fire-Rated: Face welded type.
 1. Fire Rating: Same as door or as indicated on schedule, labeled.
 2. Frame Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
- G. Bullet Resistant Door Frames (BRHM): Comply with UL 752, with same level of ballistic resistance as door; face welded construction, ground smooth, fully prepared and reinforced for hardware installation.
- H. Security Resistant Door Frames: With same security resistance as door; face welded or full profile/continuously welded construction, ground smooth, fully prepared and reinforced for hardware installation.
- I. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- J. Jamb anchors: Install 24 inch (609 mm) o.c. maximum, 3 per jamb minimum. Use type required for construction.
 1. At existing openings provide countersunk, flat exposed screws and bolts for exposed fasteners unless otherwise indicated.

- K. Mullions for Pairs of Doors: Fixed, except where removable is indicated, with profile similar to jambs.
- L. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
- M. Transom Bars: Fixed, of profile same as jamb and head.
- N. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- O. Frames Installed Back-to-Back: Reinforce with steel channels anchored to floor and overhead structure.

2.05 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
 - 1. Prime finishes on all doors and frames shall meet the ASTM humidity, salt spray, impact and film adhesion test as required by ANSI A224.1. Shop applied red oxide primers are not acceptable.
- B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

2.06 ACCESSORIES

- A. Glazing: As specified in Section 08 80 00.
- B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- C. Astragals for Double Doors: Specified in Section 08 71 00.
 - 1. Fire-Rated Doors: Steel, shape as required for fire rating.
- D. Grout for Frames: Portland cement grout with maximum 4 inch (102 mm) slump for hand troweling; thinner pumpable grout is prohibited.
- E. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.
- F. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Erect frames so that the following door clearances will occur.
 - 1. 1/8 inch (3.2 mm) at head, jambs, abutting door leaves.

2. 3/8 inch (9.5 mm) to hard surface flooring where no threshold is used.
 3. 5/8 inch (15.8 mm) at carpet and threshold to substrate floor (non-rated).
 4. 1/4 inch (6.3 mm) plus threshold height at fire rated doors.
- E. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- F. Install door hardware as specified in Section 08 71 00.
- G. Comply with glazing installation requirements of Section 08 80 00.
- H. Coordinate installation of electrical connections to electrical hardware items.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861
- B. Maximum Diagonal Distortion: 1/16 in (1.5 mm) measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.

3.06 SCHEDULE

- A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 14 16 - FLUSH WOOD DOORS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Flush wood doors; flush configuration; fire-rated and non-rated.

1.02 RELATED REQUIREMENTS

- A. Section 08 11 13 - Hollow Metal Doors and Frames.
- B. Section 08 71 00 - Door Hardware.
- C. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- B. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- C. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2016.
- D. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.
- E. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- F. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- G. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
 - 1. Provide a schedule of wood doors using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule. Include fire rating locations.
- D. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special blocking for hardware, factory finishing criteria, identify cutouts for glazing.
- E. Samples: Submit samples for selection of door veneer illustrating wood grain, stain color, and sheen.
- F. Manufacturer's Installation Instructions: Indicate special installation instructions.
- G. Specimen warranty.
- H. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage.

- C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.07 PROECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, HVAC system is operating and relative humidity is kept between 25 and 55 percent during the remainder of the construction period.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for "full life of installation" including hanging and finishing.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wood Veneer Faced Doors:
 - 1. Eggers Industries: www.eggersindustries.com/#sle.
 - 2. Graham Wood Doors: www.grahamdoors.com/#sle.
 - 3. Haley Brothers: www.haleybros.com/#sle.
 - 4. Marshfield DoorSystems, Inc: www.marshfielddoors.com/#sle.
 - 5. VT Industries, Inc.: www.vtindustries.com.
 - 6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS AND PANELS

- A. Doors: Refer to drawings for locations and additional requirements.
 - 1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
 - 2. Wood Veneer Faced Doors: 5-ply or 7-ply unless otherwise indicated.
 - 3. Bond stiles and rails to core, abrasive sand core assembly to achieve uniform thickness.
- B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at each location.
 - 2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
 - 3. Smoke and Draft Control Doors: In addition to required fire rating, provide door assemblies tested in accordance with UL 1784 with maximum air leakage of 3.0 cfm per sq ft (0.01524 cu m/s/sq m) of door opening at 0.10 inch wg (24.9 Pa) pressure at both ambient and elevated temperatures for "S" label; if necessary, provide additional gasketing or edge sealing.
 - 4. Wood veneer facing with factory transparent finish.

2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core PC or staved lumber core SLC, plies and faces as indicated.

- B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: Red oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, balance match of spliced veneer leaves assembled on door or panel face.
 - 1. Vertical Edges: Structural Composite Lumber (SCL) laminated with a matching veneer edge band. Edges to match face veneer.

2.05 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
 - 1. Blocking: Provide wood blocking in particleboard-core doors as indicated below:
 - a. Top-rail Blocking: 5 inch (125 mm).
 - b. Blocking at mortise locks, if indicated on hardware schedule.
 - c. Blocking at mid rail, for doors indicated to have exit devices.
 - 2. At Fired Rated Doors: Provide with heaviest duty stile possible for improved screw-holding capability approved for use in doors of fire-protection ratings indicated.
- C. Fire-Protection-Rated Doors:
 - 1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 - 2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
 - 1. Exception: Doors to be field finished.
- F. Cut and configure exterior door edge to receive recessed weatherstripping devices.
- G. Provide edge clearances in accordance with the quality standard specified.

2.06 FACTORY FINISHING - WOOD VENEER DOORS

- A. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
 - 1. Transparent:
 - a. System - 11, Polyurethane, Catalyzed.
 - b. Stain: As selected by SJCF. 1st floor door stain may differ from 2nd floor door stain selection.
 - c. Sheen: Satin.
- B. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

2.07 ACCESSORIES

- A. Glazing: As specified in Section 08 80 00.
- B. Glazing Stops: Rolled steel channel shape, butted corners; prepared for countersink style tamper proof screws.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
 - 1. Install fire-rated doors in accordance with NFPA 80 requirements.
 - 2. Install smoke and draft control doors in accordance with NFPA 105 requirements.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Fire-Rated Doors: Trim stiles and rails only as permitted by the labeling agency, trim height only from bottom.
- D. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 3/8 inch (9.5 mm) maximum from bottom of door to top of hard floor finish. Where carpet or threshold is scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
- E. Use machine tools to cut or drill for hardware.
- F. Coordinate installation of doors with installation of frames and hardware.
- G. Coordinate installation of glazing.

3.03 TOLERANCES

- A. Conform to specified quality standard for fit and clearance tolerances.
- B. Conform to specified quality standard for telegraphing, warp, and squareness.
- C. Maximum Diagonal Distortion (Warp): 1/8 inch (3 mm) measured with straight edge or taut string, corner to corner, over an imaginary 36 by 84 inches (915 by 2130 mm) surface area.
- D. Maximum Vertical Distortion (Bow): 1/8 inch (3 mm) measured with straight edge or taut string, top to bottom, over an imaginary 36 by 84 inches (915 by 2130 mm) surface area.
- E. Maximum Width Distortion (Cup): 1/8 inch (3 mm) measured with straight edge or taut string, edge to edge, over an imaginary 36 by 84 inches (915 by 2130 mm) surface area.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.
- C. Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

3.05 SCHEDULE - See Drawings**END OF SECTION**

SECTION 08 31 00 - ACCESS DOORS AND PANELS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Wall access door and frame units.
- B. Ceiling access door and frame units.
- C. Access doors where indicated or as required to provide access to valves, dampers, clean-outs and the like whether access doors are shown or not.

1.02 REFERENCE STANDARDS

- A. ITS (DIR) - Directory of Listed Products; current edition.
- B. UL (FRD) - Fire Resistance Directory; current edition.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of each access door and/or panel unit.
- D. Project Record Documents: Record actual locations of each access unit.

PART 2 PRODUCTS**2.01 WALL-MOUNTED UNITS**

- A. Manufacturers:
 - 1. ACUDOR Products Inc: www.acudor.com/#sle.
 - 2. Cendrex, Inc: www.cendrex.com/#sle.
 - 3. Karp Associates, Inc: www.karpinc.com.
 - 4. Milcor, Inc: www.milcorinc.com.
 - 5. Nystrom, Inc: www.nystrom.com/#sle.
 - 6. Bilco Company: www.bilco.com.
 - 7. Babcock Davis: www.babcockdavis.com.
 - 8. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Wall-Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
 - 1. Material: Steel.
 - 2. Style: Exposed frame with door surface flush with frame surface.
 - a. Gypsum Board Mounting Criteria: Use drywall bead type frame.
 - b. Plaster Mounting Criteria: Use plaster bead type frame.
 - 3. Door Style: Single thickness with rolled or turned in edges.
 - 4. Frames: 16 gage, 0.0598 inch (1.52 mm), minimum thickness.
 - 5. Heavy Duty Single Steel Sheet Door Panels: 14 gage, 0.0747 inch (1.89 mm), minimum thickness.
 - 6. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
 - a. Provide products listed by ITS (DIR) or UL (FRD) as suitable for purpose indicated.
 - 7. Steel Finish: Prime coat with baked on primer or paintable powder coat.
 - 8. Door/Panel Size: As scheduled.
 - 9. Hardware:

- a. Hardware for Fire-Rated Units: As required for listing.
 - b. Hinges for Non-Fire-Rated Units: Continuous piano hinge.
 - c. Latch/Lock: Cylinder lock-operated cam latch, two keys for each unit.
 - d. Number of Locks/Latches Required: As recommended by manufacturer for size of unit.
- C. Products and Applications
- 1. Non-Fire Rated Door and Frame Units in Walls:
 - a. In Masonry:
 - 1) Model BNT manufactured by Babcock-Davis or equal.
 - b. In Gypsum Board on Steel Studs:
 - 1) Model BNW manufactured by Babcock-Davis or equal.
 - 2. Fire Rated Door and Frame Units in Walls:
 - a. In Masonry:
 - 1) 1 1/2 hour fire rating.
 - 2) Model BUT manufactured by Babcock-Davis or equal.
 - b. In Gypsum Board on Steel Studs:
 - 1) 1 1/2 hour fire rating.
 - 2) Model BUW manufactured by Babcock-Davis or equal.
 - 3. Non-Fire Rated Door and Frame Units in Ceilings:
 - a. In Gypsum Board on Metal Furring:
 - 1) Model BNW manufactured by Babcock-Davis or equal.
 - 4. Fire Rated Door and Frame Units in Ceilings:
 - a. In Gypsum Board on Metal Furring:
 - 1) 1 1/2 hour fire rating.
 - 2) Model BIT manufactured by Babcock-Davis or equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings are correctly sized and located.

3.02 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

SECTION 08 43 13 - ALUMINUM-FRAMED STOREFRONTS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Aluminum-framed storefront, with vision glass.
- B. Infill panels of glass.
- C. Aluminum doors and frames.
- D. Weatherstripping.
- E. Perimeter sealant.

1.02 RELATED REQUIREMENTS

- A. Section 05 12 00 - Structural Steel Framing: Steel attachment members.
- B. Section 07 25 00 - Weather Barriers: Sealing framing to weather barrier installed on adjacent construction.
- C. Section 08 44 13 - Glazed Aluminum Curtain Walls.
- D. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.
- E. Section 08 80 00 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- B. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; 2009.
- C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.
- D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
- E. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.
- F. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.
- G. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- H. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.
- I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.
- K. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
- L. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
- M. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
- D. Samples: Submit samples for selection of finish and color.
- E. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.
- F. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
 - 1. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of experience.
 - 1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.07 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after the Date of Substantial Completion.
- C. Provide two year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Basis of Design: See below under description of products.
 - 1. Kawneer North America; Trifab VG 451T Storefront System - 2 x 4 1/2 inch (50.8 x 114.3 mm), Thermal: www.kawneer.com.
 - a. Glazing Position: Front-set.

2. Kawneer North America; EnCore Storefront System - 1 3/4 x 4 1/2 inch (44.5 x 114.3 mm), Non-Thermal: www.kawneer.com.
 - a. Glazing Position: Centered (front to back).
- B. Aluminum-Framed Storefront and Doors:
 1. EFCO Corporation: www.efcocorp.com.
 2. Manko Window Systems, Inc: www.mankowindows.com.
 3. Oldcastle Building Envelope: www.oldcastlebe.com.
 4. YKK AP America Inc: www.ykkap.com.
 5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 STOREFRONT

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 1. Glazing Rabbet: For 1 inch (25 mm) insulating glazing, for exterior glazing and where indicated.
 2. Glazing Rabbet: For 1/4 inch (6 mm) monolithic glazing, for interior glazing and where indicated.
 3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 6. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
 7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
 8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
 9. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.
- B. Performance Requirements:
 1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - a. Member Deflection: Limit member deflection to 1/175 in any direction, with full recovery of glazing materials.
 2. Water Penetration Resistance: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf (390 Pa).
 3. Air Leakage: Maximum of 0.06 cu ft/min sq ft (0.3 L/sec sq m) of wall area, when tested in accordance with ASTM E283 at 6.27 psf (300 Pa) pressure differential across assembly.
 4. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.

2.03 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
 - 1. Framing members for interior applications need not be thermally broken.
 - 2. Glazing Stops: Manufacturer's standard elastomeric type.
 - 3. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member, where required.
- B. Glazing: As specified in Section 08 80 00.
- C. Swing Doors: Glazed aluminum.
 - 1. Basis of Design: Kawneer North America; 500 Wide Stile Swing Door, Insulated Glass, Thermally Broken: www.kawneer.com.
 - 2. Thickness: 1-3/4 inches (43 mm).
 - 3. Top Rail: 5 inches (127 mm) wide.
 - 4. Vertical Stiles: 5 inches (127 mm) wide, Wide Style.
 - 5. Bottom Rail: 10 inches (254 mm) wide.
 - 6. Finish: Same as storefront.

2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Sheet Aluminum: ASTM B209 (ASTM B209M).
- C. Fasteners: Stainless steel.
- D. Perimeter Sealant: Silicone sealant at exterior of frame, silicone or acrylic latex sealant at interior of frame and as specified in 07 90 05 - Joint Sealers.
 - 1. Color to be selected by SJCF from manufacturer's standard colors.
- E. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.05 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.
 - 1. Color: Clear.
- B. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.06 HARDWARE

- A. For each door, include weatherstripping.
- B. Other Door Hardware: As specified in Section 08 71 00.
- C. Weatherstripping: Wool pile, continuous and replaceable; provide on all exterior doors.
 - 1. Vinyl weatherstripping shall be rejected.
- D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all exterior doors.
- E. Door Stops: Two piece type stop, equal to Kawneer 69-177.
 - 1. Fin type stops shall be rejected.

2.07 FABRICATION

- A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive anchor devices. Fabricate anchors.

- D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
- E. Arrange fasteners and attachments to conceal from view.
- F. Reinforce components internally for door hardware .
- G. Reinforce framing members for imposed loads.
- H. Doors: At frames provide compression weather stripping at fixed stops. At doors provide weather sweeps applied to door bottoms. At pairs of doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
- I. Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- J. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
 - 1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.
- C. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Install connectors and fasteners concealed in-so-far as possible, any exposed fasteners shall be colored to match framing members.
- I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- J. Set thresholds in bed of sealant and secure.
- K. Install hardware using templates provided.
 - 1. See Section 08 71 00 for hardware installation requirements.

- L. Install glass in accordance with Section 08 80 00, using glazing method required to achieve performance criteria.
- M. Install perimeter sealant in accordance with 07 90 05 - Joint Sealers and as follows:
 - 1. Seal joints with sealant per manufacturer's recommendations, allow for "weeping" to the exterior of the system - shim jamb and sill members with metal or plastic to maintain adequate space for sealants.
 - 2. Do not seal perimeter of storefront system to adjoining exterior finish material where removable face occurs; seal the frame not the trim.
- N. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 1/16 inches per 10 ft (1.5 mm/3 m), whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).
- C. Door Clearances:
 - 1. 1/8 inch (3.2 mm) at head, jambs and abutting door leaves.
 - 2. 3/8 inch (9.5 mm) at hard surface flooring where no threshold is used.
 - 3. 3/4 inch (19 mm) at carpet and threshold to substrate floor.

3.04 ADJUSTING

- A. Adjust operating hardware for smooth operation.

3.05 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

3.06 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Aluminum-framed curtain wall, with vision glazing and glass infill panels.
- B. Perimeter sealant.

1.02 RELATED REQUIREMENTS

- A. Section 05 12 00 - Structural Steel Framing: Steel attachment members.
- B. Section 07 25 00 - Weather Barriers: Sealing framing to weather barrier installed on adjacent construction.
- C. Section 08 43 13 - Aluminum-Framed Storefronts: Entrance framing and doors.
- D. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- B. AAMA 501.1 - Standard Test Method for Exterior Windows, Curtain Walls and Doors for Water Penetration Using Dynamic Pressure; 2005.
- C. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; 2009.
- D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.
- E. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
- F. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.
- G. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.
- H. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- I. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.
- J. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- K. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.
- L. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
- M. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
- N. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, and infill.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
- D. Samples: Submit samples for selection of finish and color.
- E. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure.
- F. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure.
- G. Design Calculations: Submit wind load calculations, including custom sun screens, for members of system prepared and sealed by a Structural Engineer licensed in the State of Kansas.
- H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at Kansas.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of experience.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of experience.
 - 1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.07 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.
- C. Provide two year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: See below under description of products.
 - 1. Kawneer North America; 1600 Wall System 1, 2 1/2 x 6 inch (63.5 x 152.4 mm), Thermal: www.kawneer.com.

- a. Glazing Position: Front-set.
- B. Glazed Aluminum Curtain Walls:
 - 1. EFCO, a Pella Company: www.efcocorp.com.
 - 2. Manko Window Systems, Inc: www.mankowindows.com.
 - 3. Oldcastle Building Envelope: www.oldcastlebe.com.
 - 4. Wausau Window and Wall Systems; _____: www.wausauwindow.com/#sle.
 - 5. YKK AP America Inc; _____: www.ykkap.com/#sle.
 - 6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 CURTAIN WALL

- A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. Outside glazed, with pressure plate and mullion cover.
 - 2. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 - 3. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 - 4. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 - 5. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and heel bead of glazing compound.
 - 6. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
- B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
 - 1. Design Wind Loads: Comply with the following:
 - a. Member Deflection: For spans less than 13 feet 6 inches (4115 mm), limit member deflection to 1/175 in any direction, and maximum of 1/175 of span or 3/4 inch (19 mm), whichever is less and with full recovery of glazing materials.
 - b. Member Deflection: For spans over 13 feet 6 inches (4115 mm) and less than 40 feet (12.2 m), limit member deflection to 1/175 in any direction, and maximum of 1/240 of span plus 1/4 inch (1/240 of span plus 6.4 mm), with full recovery of glazing materials.
 - 2. Movement: Accommodate the following movement without damage to components, without buckling stress on glass, damaging loads on structural elements, damaging loads on fasteners, reduction in performance, joint seal failure or deterioration of seals:
 - a. Expansion and contraction caused by 180 degrees F (82 degrees C) surface temperature.
 - b. Expansion and contraction caused by cycling temperature range of 170 degrees F (77 degrees C) over a 12 hour period.
 - c. Movement of curtain wall relative to perimeter framing.
 - d. Deflection of structural support framing, under permanent and dynamic loads.
- C. Water Penetration Resistance: No uncontrolled water on indoor face when tested as follows:
 - 1. Test Pressure Differential: 15 psf (720 Pa).
 - 2. Test Method: ASTM E 331, at a test pressure difference of 2.86 lbf/sq ft (140 Pa).
 - 3. Test Method: AAMA 501.1, at a test pressure difference of 2.86 lbf/sq ft (140 Pa).

- D. Air Leakage: Maximum of 0.06 cu ft/min sq ft (0.3 L/sec sq m) of wall area, when tested in accordance with ASTM E283 at 6.27 psf (300 Pa) pressure differential across assembly.
- E. Thermal Performance Requirements:
 - 1. Condensation Resistance Factor of Framing: 60, minimum, measured in accordance with AAMA 1503.

2.03 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
 - 1. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member, where required.
- B. Glazing: As specified in Section 08 80 00.

2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Sheet Aluminum: ASTM B209 (ASTM B209M).
- C. Structural Supporting Anchors Attached to Structural Steel: Design for bolted attachment.
- D. Structural Supporting Anchors Attached to Reinforced Concrete Members: Design for welded attachment to weld plates embedded in concrete.
- E. Fasteners: Stainless steel; type as required or recommended by curtain wall manufacturer.
- F. Perimeter Sealant: Silicone sealant at exterior of frame, silicone or acrylic latex sealant at interior of frame and as specified in 07 90 05 - Joint Sealers.
 - 1. Color to be selected by SJCF from manufacturer's standard colors.
- G. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.05 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.
 - 1. Color: Clear.
- B. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.06 FABRICATION

- A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive anchor devices. Fabricate anchors.
- D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
- E. Arrange fasteners and attachments to conceal from view.
- F. Reinforce framing members for imposed loads.
- G. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
 - 1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify dimensions, tolerances, and method of attachment with other related work.
- B. Verify that curtain wall openings and adjoining air and vapor seal materials are ready to receive work of this section.
- C. Verify that anchorage devices have been properly installed and located.
- D. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

3.02 INSTALLATION

- A. Install curtain wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Install connectors and fasteners concealed in-so-far as possible, any exposed fasteners shall be colored to match framing members.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Pressure Plate Framing: Install glazing in accordance with Section 08 80 00, using exterior dry glazing method.
- J. Install perimeter sealant in accordance with 07 90 05 - Joint Sealers and as follows:
 - 1. Seal joints with sealant per manufacturer's recommendations, allow for "weeping" to the exterior of the system - shim jamb and sill members with metal or plastic to maintain adequate space for sealants.
 - 2. Do not seal perimeter of storefront system to adjoining exterior finish material where removable face occurs; seal the frame not the trim.
- K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 0.5 inches per 100 ft (12 mm/30 m), whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).
- C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch (19 mm) and minimum of 1/4 inch (6 mm).

3.04 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.

- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

3.05 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 56 53 - SECURITY WINDOWS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Bullet resistant storefront & frame, with glazing.
- B. Speaker and other accessories.

1.02 RELATED REQUIREMENTS

- A. Section 04 20 00 - Unit Masonry: Installation of anchorage items embedded in masonry.
- B. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- C. Section 09 21 16 - Gypsum Board Assemblies: Bullet-resistant sheathing and wallboard for bullet-resistant partitions and walls.

1.03 REFERENCE STANDARDS

- A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- C. ASTM C509 - Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
- D. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass, NIJ Standard 0108.01 - (National Institute of Justice) Standard for Ballistic Resistant Protective Materials (September, 1985)
- E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing; 2014a.
- F. SSPC-Paint 33 - Coal-Tar Mastic Coating, Cold Applied; 1994 (Ed. 2006).
- G. UL 752 - Standard for Bullet-Resisting Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Furnish anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, to be embedded into concrete or masonry, with setting diagrams and installation, to applicable installer in time for installation.
- B. Preinstallation Meeting: Prior to start of installation arrange a meeting on site to familiarize installer and installers of related work with requirements relating to this work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data showing materials, construction details, dimensions of components, and finishes.
- C. Shop Drawings: Drawings prepared specifically for this project, showing plans, elevations, sections, details of construction, anchorage to other work, hardware, and glazing.
- D. Test Reports: Test reports for specific window model and glazing to be furnished, showing compliance with specified requirements; window and glazing may be tested separately, provided window test sample adequately simulates the glazing to be used.
 - 1. Include testing agency qualifications.
 - 2. For structural, forced entry, and ballistic tests, provide details on method of anchorage to test frame.

- E. Coordination Drawings: For each window opening, show locations and details of items necessary to anchor windows that must be installed by others, in sufficient detail that installer of those items can do so correctly without reference to the actual window itself.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm with at least 5 years experience in the manufacture of windows of the type specified and able to provide test reports showing that their standard manufactured products meet the specified requirements; custom designed products not acceptable.
- B. Testing Agency Qualifications: Independent testing agency able to show experience in conducting tests of the type specified and:
 - 1. Qualified according to ASTM E329 for testing tool-resisting steel.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's warranty agreeing to repair or replace windows and window components that fail within 1 years after Date of Substantial Completion due to, but not limited to, the following:
 - 1. Structural failure, failure of welds, and deterioration of metals and finishes beyond that expected under detention use and normal weathering.
 - 2. Failure of glazing due to excessive deflection of supporting members under wind load.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Bullet Resistant Storefront & Frame Assembly:
 - 1. Total Security Solutions, Inc.; TSS-BL5.5 Window Framing System:
www.tssbulletproof.com
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ASSEMBLIES

- A. Security Windows:
 - 1. Bullet resistant frame shall be constructed of an extruded aluminum in 6061-T6 alloy/tempered. Frame to have no exposed fasteners, corner joints shall consist of extruded and keyed aluminum spline. Panels shall not be removable from threat side.
 - 2. Dimensions, profiles, features, and performance specified and indicated on drawings are required; do not deviate unless specifically approved by SJCF under substitution procedures specified in Section 01 60 00.
 - 3. Design to fit openings indicated on drawings; design to accommodate deviation of actual construction from dimensions indicated on drawings.
 - 4. Design anchorages to provide performance equivalent to that required for window unit; provide anchorages at least equivalent to those by which the tested units were anchored to the test frame.
 - 5. Design interface between frame and adjacent construction so that gap between them has at least the equivalent performance as specified for window; coordinate with anchorage requirements; custom testing is not required.
 - 6. Separate dissimilar metals to prevent corrosion by galvanic action by painting contact surfaces with primer or with sealant or tape recommended by manufacturer for the purpose.

7. Label units to indicate which side is which, such as inside/outside or secure/non-secure; use labels that are removable after installation but durable enough not to be lost during delivery, storage, handling, and installation.

2.03 SECURITY BULLET RESISTANT STOREFRONT FRAMING

- A. System: Head and sill are one piece extrusions with no integral weep system at the sill. Jambs are two piece extrusions with removable faces to allow for re-glazing. Mullions are three piece extrusions with removable faces to allow for glazing and individual lite replacement. All joints and connections shall be tight, providing hairline joints and true alignment of adjacent members. Glazing must not be removable from the threat side of the sash. Provide to dimension heights and widths indicated on the Drawings.
 1. Ballistic Resistance: UL 752 Level 4 (high-power rifle) for entire system; frame and glass.
 2. Extruded Aluminum Frames:
 - a. Size 1-3/4 inches by 5-1/2 inches
 - b. Steel sections galvanized, zinc fasteners
 3. Glazing:
 - a. Glazing Type: Glass Clad Polycarbonate

2.04 ASSEMBLY COMPONENTS

- A. Deal Trays: Formed stainless steel, recessed into counter or sill for mounting under glazing frame.
 1. Clear Opening Height: 2 1/2 inches (63.3 mm).
 2. Tray Dimensions: 16 x 10 inches (____ mm), wide by deep.
 3. Listed and labeled by UL as bullet resisting to UL 752 Level 3.
- B. Electronic Communication System: Norcon TTU-1ABX bullet-resistant thru glass two way speaker.
 1. UL 752, Level 3.
 2. Continuous duty, 90-240-Volt AC power supply.
- C. Bituminous Paint: Cold-applied asbestos-free asphalt mastic, complying with SSPC-Paint 33; 30 mils, 0.030 inch (0.76 mm) minimum thickness per coat.

2.05 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that window openings are ready for installation of windows.
- B. Notify SJCF if conditions are not suitable for installation of windows; do not proceed until conditions are satisfactory.
- C. Clean and prepare all surfaces per manufacturer's recommendations for achieving the best results for the substrate under the project conditions.

3.02 INSTALLATION

- A. Do not begin installation until openings have been verified and surfaces properly prepared in accordance with Drawings. Install in accordance with manufacturer's instructions and UL 752. Set all equipment plumb.
- B. Install in accordance with manufacturer's instructions and drawing details.
- C. Install windows in correct orientation (inside/outside or secure/non-secure).
- D. Anchor windows securely in manner so as to achieve performance specified.

- E. Separate metal members from concrete and masonry using bituminous paint.

3.03 CLEANING

- A. Clean exposed surfaces promptly after installation without damaging finishes.
- B. Remove and replace defective work.

END OF SECTION

SECTION 087100 – DOOR HARDWARE**PART 1 GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Sliding doors.
 - 3. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical door hardware.
 - 3. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Door Hardware Schedule".
 - 2. Division 08 Section "Hollow Metal Doors and Frames".
 - 3. Division 08 Section "Flush Wood Doors".
 - 4. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
 - 5. Division 28 Section "Access Control".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series
 - 2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.03 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures

and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
 2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door

numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.04 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: A minimum 5 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
 2. Plans for existing and future key system expansion.
 3. Requirements for key control storage and software.
 4. Installation of permanent keys, cylinder cores and software.
 5. Address and requirements for delivery of keys.
- G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 3. Review sequence of operation narratives for each unique access controlled opening.
 4. Review and finalize construction schedule and verify availability of materials.
 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.06 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that

adequate provisions are made for locating and installing hardware to comply with indicated requirements.

- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.07 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Ten years for mortise locks and latches.
 - 2. Five years for exit hardware.
 - 3. Twenty five years for manual surface door closer bodies.
 - 4. Five years for motorized electric latch retraction exit devices.
 - 5. Two years for electromechanical door hardware.

1.08 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.02 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
 - 1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 - 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 - 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 - 4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
 - 5. Manufacturers:
 - a. Bommer Industries (BO).
 - b. Hager Companies (HA).
 - c. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).

- B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
 - 1. Manufacturers:
 - a. Bommer Industries (BO).
 - b. Hager Companies (HA).
 - c. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
 - d. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
- C. Sliding and Folding Door Hardware: Hardware is to be of type and design as specified and should comply with ANSI/BHMA A156.14.
 - 1. Sliding Bi-Passing Pocket Door Hardware: Provide complete sets consisting of track, hangers, stops, bumpers, floor channel, guides, and accessories indicated.
 - 2. Bi-folding Door Hardware: Rated for door panels weighing up to 125 lb.
 - 3. Pocket Sliding Door Hardware: Rated for doors weighing up to 200 lb.
 - 4. Manufacturers:
 - a. Hager Companies (HA).
 - b. Johnson Hardware (JO).
 - c. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.03 POWER TRANSFER DEVICES

- A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
 - 1. Manufacturers:
 - a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) – EL-CEPT Series.
 - b. Securitron (SU) - EL-CEPT Series.
- B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
 - 1. Provide one each of the following tools as part of the base bid contract:

- a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Electrical Connecting Kit: QC-R001.
 - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.
2. Manufacturers:
 - a. Hager Companies (HA) - Quick Connect.
 - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - QC-C Series.

2.04 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
 2. Furnish dust proof strikes for bottom bolts.
 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 5. Manufacturers:
 - a. Burns Manufacturing (BU).
 - b. Door Controls International (DC).
 - c. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
- B. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
 5. Manufacturers:
 - a. Burns Manufacturing (BU).
 - b. Hiawatha, Inc. (HI).
 - c. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.05 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
- C. Cylinders: Original manufacturer cylinders complying with the following:
 - 1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
 - 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
 - 4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
- D. Keying System: Each type of lock and cylinders to be factory keyed.
 - 1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
 - 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 - 3. Existing System: Key locks to Owner's existing system.
- E. Key Quantity: Provide the following minimum number of keys:
 - 1. Change Keys per Cylinder: Two (2)
 - 2. Master Keys (per Master Key Level/Group): Five (5).
 - 3. Construction Keys (where required): Ten (10).
 - 4. Construction Control Keys (where required): Two (2).
 - 5. Permanent Control Keys (where required): Two (2).
- F. Construction Keying: Provide construction master keyed cylinders.
- G. Construction Keying: Provide temporary keyed construction cores.
- H. Key Registration List (Bitting List):
 - 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 - 2. Provide transcript list in writing or electronic file as directed by the Owner.
- I. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
 - 1. Manufacturers:
 - a. Lund Equipment (LU).
 - b. MMF Industries (MM).
 - c. Telkee (TK).

2.06 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA 156.13 requirements to 10 million cycles.
2. Manufacturers:
 - a. Yale Locks and Hardware (YA) – 8800FL Series.
 - b. No Substitution.

2.07 ELECTROMECHANICAL LOCKING DEVICES

- A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below.
1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.
 2. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
 3. High Security Monitoring: Provide lock bodies which have built-in request to exit monitoring and are provided with accompanying door position switches. Provide a resistor configuration which is compatible with the access control system.
 4. Manufacturers:
 - a. Yale Locks and Hardware (YA) – 8800FL Series.
 - b. No Substitution.

2.08 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
 4. Dustproof Strikes: BHMA A156.16.

2.09 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 5. Electromechanical Options: Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified in hardware sets. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.
 6. Motorized Electric Latch Retraction: Devices with an electric latch retraction feature must use motors which have a maximum current draw of 600mA. Solenoid driven latch retraction is not acceptable.
 7. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 8. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 9. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 10. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 11. Extended cycle test: Devices to have been cycle tested in ordinance with ANSI/BHMA 156.3 requirements to 9 million cycles.
 12. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 13. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
 - b. Sargent Manufacturing (SA) - 80 Series.

2.10 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
 1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
 4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
 5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 - 6.
 7. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 8. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
 1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DC8000 Series.
 - b. Sargent Manufacturing (SA) - 351 Series.
 - c. Norton Door Controls (NO) - 7500 Series.
 - d. Yale Locks and Hardware (YA) - 4400 Series.
- C. Door Closers, Surface Mounted (Unitrol): Unitrol arms to have door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width.
 1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - Unitrol Series.

- b. Norton Door Controls (NO) - Unitrol Series.
- c. Yale Locks and Hardware (YA) - Unitrol Series.

2.11 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, 050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
 - a. Burns Manufacturing (BU).
 - b. Hager Companies (HA).
 - c. Hiawatha, Inc. (HI).
 - d. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.12 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Manufacturers:
 - a. Burns Manufacturing (BU).
 - b. Hager Companies (HA).
 - c. Hiawatha, Inc. (HI).
 - d. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide

non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:
 - a. Rixson Door Controls (RF).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Sargent Manufacturing (SA).

2.13 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 1. National Guard Products (NG).
 2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
 3. Reese Enterprises, Inc. (RE).

2.14 ELECTRONIC ACCESSORIES

- A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.
 1. Manufacturers:

- a. Sargent Manufacturing (SA) – 3280 Series.
- b. Security Door Controls (SD) - DPS Series.
- c. Securitron (SU) - DPS Series.

2.15 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.16 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.02 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.03 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.04 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.05 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.06 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.

- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.07 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.08 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.
- C. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. YA - Yale
4. RO - Rockwood
5. SA - Sargent
6. RF - Rixson
7. NO - Norton
8. SU - Securitron

Hardware Sets

Set: 1.0

Doors: 101A, 101B

Description: Exterior

1 Continuous Hinge	CFMSLF-HD1 or CFMSLI-HD1	PE
1 Exit Device (storeroom)	LC 16 8804 PSB	US32D SA
1 Surface Closer	UNI7500	689 NO
1 Drop Plate	7788	689 NO
1 Door Stop	462	US2C RO
1 Threshold	279x292AFGPK x Opening Width	PE
1 Sweep	345ANB x Door Width	PE

Notes: Weatherstripping furnished by Aluminum Door Supplier.
Cylinder furnished by Central Key & Safe.

Set: 2.0

Doors: 140B

Description: Exterior (Rated)

1 Continuous Hinge	CFMHD1 PT x Door Height		PE
1 Exit Device (storeroom)	12 LC 55 56 8804 PSB	US32D	SA
1 Surface Closer	UNI7500 SN-134	689	NO
1 Kick Plate	K1050 10" x 2" LDW CSK	US32D	RO
1 Door Stop	462	US2C	RO
1 Threshold	279x292AFGPK x Opening Width		PE
1 Gasketing	S773D (Head & Jambs)		PE
1 Rain Guard	346C x Overall Frame Width		PE
1 Sweep	345ANB x Door Width		PE
1 Electric Power Transfer	EL-CEPT		SU
1 ElectroLynx Harness	QC-C1500P		MK
1 ElectroLynx Harness	QC-C Length Required		MK
1 Position Switch	DPS-M-BK		SU

Notes: Card reader and power supply furnished by access control supplier.

Cylinders furnished by Central Key & Safe.

Operation: Door is normally closed and locked. When a valid credential is presented to the wall mounted card reader the latch on the exit devices will retract and you can pull the door open. When the door comes back closed the latch will project and the door will be locked. There will be a REX or request to exit switch built into the push pad on the exit device. You can always exit out of the space by pushing on the push pad on the exit device and exiting out of the space.

Set: 3.0

Doors: 158

Description: Exterior (Rated)

1 Continuous Hinge	CFMHD1 PT x Door Height		PE
1 Fail Secure Lock	AUR 8891FL LC REX	626	YA
1 Surface Closer	UNI7500 SN-134	689	NO
1 Kick Plate	K1050 10" x 2" LDW CSK	US32D	RO
1 Door Stop	462	US2C	RO
1 Threshold	279x292AFGPK x Opening Width		PE
1 Gasketing	S773D (Head & Jambs)		PE
1 Rain Guard	346C x Overall Frame Width		PE
1 Sweep	345ANB x Door Width		PE
1 Electric Power Transfer	EL-CEPT		SU
1 ElectroLynx Harness	QC-C1500P		MK
1 ElectroLynx Harness	QC-C Length Required		MK
1 Position Switch	DPS-M-BK		SU

Notes: Card reader and power supply furnished by access control supplier.

Cylinder furnished by Central Key & Safe.

Operation: Door is normally closed and locked. When a valid credential is presented to the wall mounted card reader the outside trim on the mortise lock will release and you can turn the lever and enter the space. When the door comes back closed the outside trim will

relock. The inside lever will have a REX or request to exit switch built into the lock. You can always exit out of the space by turning the inside lever and exiting the space.

Set: 4.0

Doors: 102A, 102B, 104A, 104B, 117

Description: Vestibule

Notes: All hardware furnished by Door Supplier.

Set: 5.0

Doors: 103

Description: Security (Bullet Resistant)

3 Hinge	T4A3786 NRP 5" x 4-1/2"	US26D	MK
1 Fail Secure Lock	AUR 8891FL LC REX	626	YA
1 Surface Closer	CLP7500	689	NO
1 Kick Plate	K1050 10" x 2" LDW CSK	US32D	RO
3 Silencer	608		RO
1 Electric Power Transfer	EL-CEPT		SU
1 ElectroLynx Harness	QC-C1500P		MK
1 ElectroLynx Harness	QC-C Length Required		MK
1 Position Switch	DPS-M-BK		SU

Notes: Card reader and power supply furnished by access control supplier.

Cylinder furnished by Central Key & Safe.

Operation: Door is normally closed and locked. When a valid credential is presented to the wall mounted card reader the outside trim on the mortise lock will release and you can turn the lever and enter the space. When the door comes back closed the outside trim will relock. The inside lever will have a REX or request to exit switch built into the lock. You can always exit out of the space by turning the inside lever and exiting the space.

Set: 6.0

Doors: 107, 141, 201A

Description: Hall

3 Hinge	TA2714 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Fail Secure Lock	AUR 8891FL LC REX	626	YA
1 Surface Closer	PR7500	689	NO
1 Kick Plate	K1050 10" x 2" LDW CSK	US32D	RO
1 Wall Stop	409	US32D	RO
3 Silencer	608		RO
1 Electric Power Transfer	EL-CEPT		SU
1 ElectroLynx Harness	QC-C1500P		MK
1 ElectroLynx Harness	QC-C Length Required		MK
1 Position Switch	DPS-W-BK or DPS-M-BK as required		SU

Notes: Card reader and power supply furnished by access control supplier.

Cylinder furnished by Central Key & Safe.

Operation: Door is normally closed and locked. When a valid credential is presented to the wall mounted card reader the outside trim on the mortise lock will release and you can turn the lever and enter the space. When the door comes back closed the outside trim will

relock. The inside lever will have a REX or request to exit switch built into the lock. You can always exit out of the space by turning the inside lever and exiting the space.

Set: 7.0

Doors: 108, 111, 124, 135, 139, 145, 146, 153, 159, 160, 205, 216, 218, 221, 222, 223, 224, 226, 228, 233, 238

Description: Office

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Entry Lock	AUR 8807FL LC	626	YA
1 Wall Stop	409	US32D	RO
3 Silencer	608		RO
1 Gasketing	S773D (Head & Jambs)		PE

Notes: Cylinder furnished by Central Key & Safe.

Set: 8.0

Doors: 109A, 110, 118, 122A, 133, 142, 144

Description: Hall, SRVR, Vestibule, Storage, Office

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Fail Secure Lock	AUR 8891FL LC REX	626	YA
1 Surface Closer	7500	689	NO
1 Kick Plate	K1050 10" x 2" LDW CSK	US32D	RO
1 Wall Stop	409	US32D	RO
3 Silencer	608		RO
1 Electric Power Transfer	EL-CEPT		SU
1 ElectroLynx Harness	QC-C1500P		MK
1 ElectroLynx Harness	QC-C Length Required		MK
1 Position Switch	DPS-W-BK or DPS-M-BK as required		SU
1 Gasketing	S773D (Head & Jambs)		PE

Notes: Card reader and power supply furnished by access control supplier.

Cylinder furnished by Central Key & Safe.

Operation: Door is normally closed and locked. When a valid credential is presented to the wall mounted card reader the outside trim on the mortise lock will release and you can turn the lever and enter the space. When the door comes back closed the outside trim will relock. The inside lever will have a REX or request to exit switch built into the lock. You can always exit out of the space by turning the inside lever and exiting the space.

Set: 9.0

Doors: 115, 116, 119, 137, 138

Description: InTV

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Passage Latch	AUR 8801FL	626	YA
1 Wall Stop	409	US32D	RO
1 Threshold	2009APK x Opening Width		PE
1 Gasketing	S773D (Head & Jambs)		PE

Notes: Balance of hardware is existing and will remain.

Set: 10.0

Doors: 120, 121

Description: Toilet

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Privacy Lock	AUR 8802FL	626	YA
1 Wall Stop	409	US32D	RO
1 Gasketing	S773D (Head & Jambs)		PE

Set: 11.0

Doors: 122B

Description: Vestibule

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Push Plate	70C-RKW	US32D	RO
1 Pull Plate	BF 107x70C	US32D	RO
1 Surface Closer	7500	689	NO
1 Kick Plate	K1050 10" x 2" LDW CSK	US32D	RO
1 Wall Stop	409	US32D	RO
3 Silencer	608		RO

Set: 12.0

Doors: 125, 150, 203, 217

Description: Janitor, Storage

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom or Closet Lock	AUR 8805FL LC	626	YA
1 Wall Stop	409	US32D	RO
3 Silencer	608		RO

Notes: Cylinder furnished by Central Key & Safe.

Set: 13.0

Doors: 126

Description: Laser

3 Hinge	T4A3786 5" x 4-1/2"	US26D	MK
1 Passage Latch	AUR 8801FL	626	YA
1 Surf Overhead Stop	9 Series	652	RF
3 Silencer	608		RO

Set: 14.0

Doors: 127

Description: Evidence

3 Hinge	T4A3786 5" x 4-1/2"	US26D	MK
1 Fail Secure Lock	AUR 8891FL LC REX	626	YA
1 Surface Closer	7500	689	NO

1 Kick Plate	K1050 10" x 2" LDW CSK	US32D	RO
1 Wall Stop	409	US32D	RO
3 Silencer	608		RO
1 Electric Power Transfer	EL-CEPT		SU
1 ElectroLynx Harness	QC-C1500P		MK
1 ElectroLynx Harness	QC-C Length Required		MK
1 Position Switch	DPS-W-BK or DPS-M-BK as required		SU

Notes: Card reader and power supply furnished by access control supplier.

Cylinder furnished by Central Key & Safe.

Operation: Door is normally closed and locked. When a valid credential is presented to the wall mounted card reader the outside trim on the mortise lock will release and you can turn the lever and enter the space. When the door comes back closed the outside trim will relock. The inside lever will have a REX or request to exit switch built into the lock. You can always exit out of the space by turning the inside lever and exiting the space.

Set: 15.0

Doors: 128

Description: Photo

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Passage Latch	AUR 8801FL	626	YA
1 Surf Overhead Stop	9 Series	652	RF
3 Silencer	608		RO

Set: 16.0

Doors: 130

Description: Hall

3 Hinge	T4A3786 NRP 5" x 4-1/2"	US26D	MK
1 Fail Secure Lock	AUR 8891FL LC REX	626	YA
1 Surface Closer	PR7500	689	NO
1 Kick Plate	K1050 10" x 2" LDW CSK	US32D	RO
1 Wall Stop	409	US32D	RO
3 Silencer	608		RO
1 Electric Power Transfer	EL-CEPT		SU
1 ElectroLynx Harness	QC-C1500P		MK
1 ElectroLynx Harness	QC-C Length Required		MK
1 Position Switch	DPS-W-BK or DPS-M-BK as required		SU

Notes: Card reader and power supply furnished by access control supplier.

Cylinder furnished by Central Key & Safe.

Operation: Door is normally closed and locked. When a valid credential is presented to the wall mounted card reader the outside trim on the mortise lock will release and you can turn the lever and enter the space. When the door comes back closed the outside trim will relock. The inside lever will have a REX or request to exit switch built into the lock. You can always exit out of the space by turning the inside lever and exiting the space.

Set: 17.0

Doors: 132

Description: Supply

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	AUR 8808FL LC	626	YA
1 Surf Overhead Stop	9 Series	652	RF
3 Silencer	608		RO

Notes: Cylinder furnished by Central Key & Safe.

Set: 18.0

Doors: 136

Description: Storage

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Dormitory Lock	AUR 8822FL LC	626	YA
1 Door Stop	441H	US26D	RO
1 Threshold	2009APK x Opening Width		PE
1 Gasketing	S773D (Head & Jambs)		PE
1 Auto Door Bottom	411ARL x Door Width		PE

Notes: Cylinder furnished by Central Key & Safe.

Set: 19.0

Doors: 140A

Description: Vestibule

3 Hinge	T4A3786 NRP 5" x 4-1/2"	US26D	MK
1 Fail Secure Lock	AUR 8891FL LC REX	626	YA
1 Surface Closer	CLP7500	689	NO
1 Kick Plate	K1050 10" x 2" LDW CSK	US32D	RO
3 Silencer	608		RO
1 Electric Power Transfer	EL-CEPT		SU
1 ElectroLynx Harness	QC-C1500P		MK
1 ElectroLynx Harness	QC-C Length Required		MK
1 Position Switch	DPS-W-BK or DPS-M-BK as required		SU

Notes: Card reader and power supply furnished by access control supplier.

Cylinder furnished by Central Key & Safe.

Operation: Door is normally closed and locked. When a valid credential is presented to the wall mounted card reader the outside trim on the mortise lock will release and you can turn the lever and enter the space. When the door comes back closed the outside trim will relock. The inside lever will have a REX or request to exit switch built into the lock. You can always exit out of the space by turning the inside lever and exiting the space.

Set: 20.0

Doors: 147, 151, 154, 161, 219, 240

Description: Conference IV

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Passage Latch	AUR 8801FL	626	YA
1 Wall Stop	409	US32D	RO
3 Silencer	608		RO
1 Gasketing	S773D (Head & Jambs)		PE

Set: 21.0

Doors: 152

Description: Closet

6 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
2 Roller Latch	592	US26D	RO
2 Dummy Trim Single	AUR 855FL	626	YA
2 Wall Stop	409	US32D	RO
2 Silencer	608		RO

Set: 22.0

Doors: 206

Description: Office

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Entry Lock	AUR 8807FL LC	626	YA
1 Surf Overhead Stop	9 Series	652	RF
3 Silencer	608		RO
1 Gasketing	S773D (Head & Jambs)		PE

Notes: Cylinder furnished by Central Key & Safe.

Set: 23.0

Doors: 213,

Description: Waiting

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Fail Secure Lock	AUR 8891FL LC REX	626	YA
1 Surface Closer	CLP7500	689	NO
1 Kick Plate	K1050 10" x 2" LDW CSK	US32D	RO
3 Silencer	608		RO
1 Electric Power Transfer	EL-CEPT		SU
1 ElectroLynx Harness	QC-C1500P		MK
1 ElectroLynx Harness	QC-C Length Required		MK
1 Position Switch	DPS-W-BK or DPS-M-BK as required		SU

Notes: Card reader and power supply furnished by access control supplier.

Cylinder furnished by Central Key & Safe.

Operation: Door is normally closed and locked. When a valid credential is presented to the wall mounted card reader the outside trim on the mortise lock will release and you can turn the lever and enter the space. When the door comes back closed the outside trim will

relock. The inside lever will have a REX or request to exit switch built into the lock. You can always exit out of the space by turning the inside lever and exiting the space.

Set: 24.0

Doors: 219B

Description: Storage

1 Sliding System	BLD-FT-02IS x Length Required		PE
1 Door Pull	BF 112 Mtg-Type 1HD	US32D	RO
1 Soft Close	BLD-1411-1		PE

Set: 25.0

Doors: 227

Description: Storage

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	AUR 8808FL LC	626	YA
1 Wall Stop	409	US32D	RO
3 Silencer	608		RO

Notes: Cylinder furnished by Central Key & Safe.

Set: 26.0

Doors: 237

Description: Storage

1 Sliding Door Hdwe	HF4/100A x Length Required		PE
2 Pull	853	US32D	RO

Set: 27.0

Doors: 239

Description: Waiting

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Fail Secure Lock	AUR 8891FL LC REX	626	YA
1 Surface Closer	CLP7500	689	NO
1 Kick Plate	K1050 10" x 2" LDW CSK	US32D	RO
3 Silencer	608		RO
1 Electric Power Transfer	EL-CEPT		SU
1 ElectroLynx Harness	QC-C1500P		MK
1 ElectroLynx Harness	QC-C Length Required		MK
1 Position Switch	DPS-W-BK or DPS-M-BK as required		SU

Notes: Card reader and power supply furnished by access control supplier.

Cylinder furnished by Central Key & Safe.

Operation: Door is normally closed and locked. When a valid credential is presented to the wall mounted card reader the outside trim on the mortise lock will release and you can turn the lever and enter the space. When the door comes back closed the outside trim will relock. The inside lever will have a REX or request to exit switch built into the lock. You can always exit out of the space by turning the inside lever and exiting the space.

Set: 28.0

Doors: Misc.

Description: Extra's for the project

2 ElectroLynx Harness	QC-C1500P	MK
1 ElectroLynx Harness	QC-C012P	MK
1 ElectroLynx Harness	QC-C300P	MK
1 Repair Kit	QC-R001	MK
1 Crimp Tool	QC-R003	MK
1 ElectroLynx Harness	QC-C400P	MK
1 ElectroLynx Harness	QC-C2500P	MK

Set: 29.0

Doors: Temporary Stair 3 (2 qty.)

Description: Interior

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Exit Device (storeroom)	LC LD 8804 PSB	US32D	SA
1 Electric Strike	74R1M	130	AD
1 Surface Closer	CLP7500	689	NO
1 Wall Stop	409	US2D	RO
3 Silencer	608		RO
1 Position Switch	DPS-W-BK or DPS-M-BK as req'd		SU

Notes: Card reader and power supply furnished by access control supplier.
Cylinder furnished by Central Key & Safe.

Set: 30.0

Doors: Temporary Entrance (Stair 3)

Description: Exterior

Cont. Hinge or butts			
1 Exit Device (storeroom)	LC 16 8804 PSB	US32D	SA
1 Surface Closer	UNI7500	689	NO
1 Drop Plate	7788	689	NO
1 Door Stop	462	US2C	RO
1 Sweep	345ANB x Door Width		PE

Notes: Weatherstripping furnished by Aluminum Door Supplier.
Cylinder furnished by Central Key & Safe.

Set: 31.0

Doors: 246

Description: Waiting

1 Fail Secure Lock	AUR 8891FL LC REX	626	YA
1 Electric Power Transfer	EL-CEPT		SU

1 ElectroLynx Harness	QC-C1500P	MK	
1 ElectroLynx Harness	QC-C Length Required	MK	
1 Position Switch	DPS-W-BK or DPS-M-BK as required		SU

Notes: Card reader and power supply furnished by access control supplier.

Cylinder furnished by Central Key & Safe.

Operation: Door is normally closed and locked. When a valid credential is presented to the wall mounted card reader the outside trim on the mortise lock will release and you can turn the lever and enter the space. When the door comes back closed the outside trim will relock. The inside lever will have a REX or request to exit switch built into the lock. You can always exit out of the space by turning the inside lever and exiting the space.

END OF SECTION 087100

SECTION 08 80 00 - GLAZING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Insulating glass units.
- B. Glazing units.
- C. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- B. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.
- C. Section 08 43 13 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.
- D. Section 08 44 13 - Glazed Aluminum Curtain Walls: Glazing furnished as part of wall assembly.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.
- C. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.
- D. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.
- E. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).
- F. ASTM C1036 - Standard Specification for Flat Glass; 2011.
- G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
- H. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2014.
- I. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.
- J. ASTM C1349 - Standard Specification for Architectural Flat Glass Clad Polycarbonate; 2010.
- K. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2015.
- L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- M. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.
- N. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2012a.
- O. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.
- P. GANA (GM) - GANA Glazing Manual; 2009.
- Q. GANA (SM) - GANA Sealant Manual; 2008.

- R. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.
- S. ICC (IBC) - International Building Code; 2015.
- T. ITS (DIR) - Directory of Listed Products; current edition.
- U. NAAMM AMP 500-06 - Metal Finishes Manual; 2006.
- V. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.
- W. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies; 2012.
- X. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2014.
- Y. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014.
- Z. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2014.
- AA. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.
- AB. UL 9 - Standard for Fire Tests of Window Assemblies; Current Edition, Including All Revisions.
- AC. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- AD. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- AE. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.
- AF. UL 752 - Standard for Bullet-Resisting Equipment; Current Edition, Including All Revisions.
- AG. UL 972 - Standard for Burglary Resisting Glazing Material; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- D. Samples: Submit two samples 12 by 12 inch (304 by 304 mm) in size of glass units.
- E. Certificate: Certify that products of this section meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM), GANA (SM), and GANA (LGRM) for glazing installation methods.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years experience.
- D. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

1.06 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.
- C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including replacement of failed units.
- D. Glass-Ceramic Safety Glazing: Provide a five (5) year warranty to include replacement of failed units.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Float Glass Manufacturers:
 - 1. AGC Glass Company North America, Inc: www.us.agc.com.
 - 2. Guardian Industries Corp: www.sunguardglass.com.
 - 3. Pilkington North America Inc: www.pilkington.com/na.
 - 4. PPG Industries, Inc: www.ppgideascape.com.
 - 5. Substitutions: Refer to Section 01 60 00 - Product Requirements.
- B. Plastic Films Manufacturers (non-security related):
 - 1. 3M Window Film: www.3m.com.
 - 2. Flexvue Films: www.flexvuefilms.com.
 - 3. Llumar, an Eastman Chemical Company: www.llumar.com/#sle.
 - 4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
 - 1. Design Pressure: Calculated in accordance with ASCE 7.
 - 2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 - 3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
 - 4. Glass thicknesses listed are minimum.
- B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
 - 1. In conjunction with vapor retarder and joint sealer materials described in other sections.
 - 2. To maintain a continuous vapor retarder and air barrier throughout the glazed assembly from glass pane to heel bead of glazing sealant.
- C. Thermal and Optical Performance: Provide glass products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:

1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless noted otherwise.
 1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality-Q3.
 2. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and FT.
 3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria.
 4. Impact Resistant Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria; Class A/Category II.
 5. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality-Q3, color and performance characteristics as indicated.
 6. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.
- B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
 1. Laminated Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 test requirements for Category II.
 2. Polyvinyl Butyral (PVB) Interlayer: 0.060 inch (1.524 mm) thick, minimum.

2.04 INSULATING GLASS UNITS

- A. Insulating Glass Units: Types as indicated.
 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
 3. Spacer Color: Black.
 4. Edge Seal:
 - a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
 5. Color: Black.
 6. Purge interpane space with dry air, hermetically sealed.
- B. Insulating Glass Units: Vision glass, double glazed.
 1. Applications: Exterior glazing unless otherwise indicated.
 2. See Basis of Design - Insulating Glass Units below.
- C. Insulating Glass Units: Spandrel glazing.
 1. Applications: Exterior spandrel glazing unless otherwise indicated.
 2. Outboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
 - a. Tint: Same as vision units.
 - b. Coating: Same as on vision units, on #2 surface.
 - 1) If spandrel glazing is exposed to the room side, provide ceramic frit on #2 surface as well as the inboard lite. Match color of inboard lite.
 3. Inboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick.
 - a. Tint: Same as vision units.
 - b. Opacifier: Ceramic frit, on #3 surface.
 - c. Opacifier Color: To be selected from manufacturer's standard colors.
 4. Total Thickness: 1 inch (25.4 mm).
- D. Insulating Glass Units: Safety glazing.

1. Applications:
 - a. Glazed lites in exterior doors.
 - b. Glazed sidelights and panels next to doors.
 - c. Other locations required by applicable federal, state, and local codes and regulations.
 - d. Other locations indicated on drawings.
2. Space between lites filled with air.
3. Glass Type: Same as other vision glazing except use fully tempered float glass for both outboard and inboard lites.

2.05 BASIS OF DESIGN - INSULATING GLASS UNITS

- A. Typ. Insulating Glass Units: Vision glazing, with Low-E coating.
 1. Applications: Exterior insulating glass glazing unless otherwise indicated.
 2. Space between lites filled with air.
 3. Total Thickness: 1 inch (25.4 mm).
 4. Basis of Design - PPG Industries, Inc: www.ppgideascape.com/#sle.
 5. Outboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
 - a. Low-E Coating: PPG Solarban 60 on #2 surface.
 - b. Tint: Clear.
 6. Inboard Lite: Fully tempered float glass, 1/4 inch (6 mm) thick.
 - a. Tint: Clear.
 7. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of another acceptable manufacturer.
 - a. Other products of other manufacturers will be considered provided the overall performance is within the specified range(s) and the overall appearance is not significantly different from that of the specified product.
 - b. SJCF's decision on substitutions is final.
 8. Substitution Procedures: See Section 01 60 00 - Product Requirements.
 - a. For any product not identified as "Basis of Design", submit information as specified for substitutions.
- B. Laminated Insulating Glass Units: Vision glazing, with Low-E coating.
 1. Applications: Exterior insulating glass glazing where scheduled.
 2. Space between lites filled with air.
 3. Total Thickness: 1 1/8" inch (28.6 mm).
 4. Basis of Design - PPG Industries, Inc: www.ppgideascape.com/#sle.
 5. Outboard Lite: Laminated 7/16 inch (4.8 mm) thick, minimum.
 - a. 3/16" fully tempered float glass, Polyvinyl Butyral (PVB) Interlayer: 0.060 inch (1.524 mm) thick, minimum, 3/16" fully tempered float glass.
 - b. Tint: Clear.
 6. Inboard Lite: Fully tempered float glass, 1/4 inch (6 mm) thick.
 - a. Low-E Coating: PPG Solarban 60 on #5 surface.
 - b. Tint: Clear.

2.06 GLAZING UNITS

- A. Monolithic Interior Vision Glazing:
 1. Applications: Interior glazing unless otherwise indicated.
 2. Glass Type: Annealed float glass.
 3. Tint: Clear.
 4. Thickness: 1/4 inch (6.4 mm), nominal.
- B. Monolithic Safety Glazing: Non-fire-rated.
 1. Applications:
 - a. Glazed lites in doors, except fire doors.

- b. Glazed sidelights to doors, except in fire-rated walls and partitions.
 - c. Other locations required by applicable federal, state, and local codes and regulations.
 - d. Other locations indicated on drawings.
- 2. Glass Type: Fully tempered or laminated safety glass as specified.
- 3. Tint: Clear.
- 4. Thickness: 1/4 inch (6.4 mm), nominal.
- C. Type G-7 - Detention Glazing: Laminated glass, 3-ply.
 - 1. Applications: Locations as indicated on drawings.
 - 2. Tint: Clear.
 - 3. Thickness: As required to meet performance criteria.
 - 4. Outside Lite: Heat-strengthened glass.
 - 5. Interlayer, Outboard Side: Polyvinyl butyral (PVB); thickness as required to meet performance criteria.
 - 6. Middle Lite: Heat-strengthened glass.
 - 7. Interlayer, Inboard Side: Polyvinyl butyral (PVB); thickness as required to meet performance criteria.
 - 8. Inside Lite: Heat-strengthened glass.
 - 9. Performance Criteria:
 - a. Burglary Resistance: Pass UL 972 tests in compliance with level of burglary and forced-entry resistance indicated; Multiple Impact.
- D. Type G-9 - Glass-Clad Polycarbonate Security Glazing: Laminated glass and polycarbonate, multi-ply; ASTM C1349.
 - 1. Applications: Locations as indicated on drawings.
 - 2. Tint: Clear.
 - 3. Thickness: As required to meet performance criteria.
 - 4. Outer Lite: Tempered glass.
 - 5. Interlayer: Polyvinyl butyral (PVB), thickness as required to meet performance criteria.
 - 6. Inside Lite: Polycarbonate.
 - 7. Performance Criteria:
 - a. Bullet Resistance: Pass UL 752 tests in compliance with ballistic criteria level and weapon description indicated; Level 4 - .30 caliber rifle lead core.

2.07 GLAZING COMPOUNDS

- A. Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
- C. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

2.08 ACCESSORIES

- A. Setting Blocks: EPDM, Neoprene or Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) x width of glazing rabbet space minus 1/16 inch (1.5 mm) x height to suit glazing method and pane weight and area.

- B. Spacer Shims: Neoprene or Silicone, 50 to 60 Shore A durometer hardness; ASTM C864 Option I. Minimum 3 inch (75 mm) long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.
- C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
- D. Glazing Gaskets: Resilient polyvinyl chloride or silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option I; color black.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
 - 1. Take glass sizes from frames at job site.
- B. Verify that the minimum required face and edge clearances are being provided.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- D. Verify that sealing between joints of glass framing members has been completed effectively.
- E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- 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. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- E. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- F. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- G. 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.

- 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. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove non-permanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.05 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 09 05 61 - COMMON WORK RESULTS FOR FLOORING PREPARATION**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. This section applies to floors identified in contract documents that are receiving the following types of floor coverings:
 - 1. Resilient tile and sheet.
 - 2. Sheet carpeting.
 - 3. Carpet tile.
- B. Removal of existing floor coverings.
- C. Contractor: Preparation of new and existing concrete floor slabs for installation of floor coverings.
- D. Testing of concrete floor slabs for moisture and alkalinity (pH).
- E. Patching compound.
- F. Remedial floor coatings.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Moisture emission reducing curing and sealing compound for slabs to receive adhered flooring, to prevent moisture content-related flooring failures; to remain in place, not to be removed.
- B. Section 03 30 00 - Cast-in-Place Concrete: Concrete admixture for slabs to receive adhered flooring, to prevent moisture content-related flooring failures.
- C. Section 03 30 00 - Cast-in-Place Concrete: Limitations on curing requirements for new concrete floor slabs.

1.03 REFERENCE STANDARDS

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
- B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.
- C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2011.
- D. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; October 2011.

1.04 SUBMITTALS

- A. Visual Observation Report: For existing floor coverings to be removed.
- B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
 - 1. Moisture and alkalinity (pH) limits and test methods.
 - 2. Manufacturer's required bond/compatibility test procedure.
- C. Testing Agency's Report:
 - 1. Description of areas tested; include floor plans and photographs if helpful.
 - 2. Summary of conditions encountered.
 - 3. Moisture and alkalinity (pH) test reports.
 - 4. Copies of specified test methods.
 - 5. Submit report not more than two business days after conclusion of testing.

1.05 QUALITY ASSURANCE

- A. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

1.07 FIELD CONDITIONS

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F (18 degrees C) or more than 85 degrees F (30 degrees C).
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS**2.01 MATERIALS**

- A. Patching Compound:
 - 1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
 - 2. Rated for use interior and exterior.
 - 3. Calcium aluminate content; gypsum content is prohibited.
 - 4. Products:
 - a. Mapei; Mapecem QuickPatch: www.mapei.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Floor Leveling Compound:
 - 1. Hydraulic-cement-based, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
 - 2. Rated for use interior and exterior.
 - 3. Not affected by exposure to intermittent rain, 6 hours after install.
 - 4. Not affected by freezing temperatures, 3 days after install.
 - 5. Products:
 - a. Mapei; Ultraplan Extreme 2: www.mapei.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Remedial Floor Coating (Apply under Vinyl or Rubber Floor): Single- or multi-layer coating or coating/overlay combination.
 - 1. Moisture control for slabs with moisture vapor emission rates (MVERs) up to 15 lbs (6.8 kg) and relative humidity (RH) up to 99% per ASTM F2170.
 - 2. Alkalinity protection for slabs up to pH of 12.
 - 3. Thickness: As required for application and in accordance with manufacturer's installation instructions.
 - 4. Products:
 - a. Custom Building Products; TechMVC Moisture Vapor and Alkalinity Barrier: www.custombuildingproducts.com/#sle.

- b. LATICRETE International, Inc; LATICRETE NXT Vapor Reduction Coating with LATICRETE NXT Level Plus: www.laticrete.com/#sle.
- c. Proflex Products, Inc; MS 225: www.proflex.us.
- d. TEC, an H.B. Fuller Construction Products Brand; TEC LiquiDam EZ with TEC Level Set 200 SLU: www.tecspecialty.com/#sle.
- e. Tnemec Company, Inc; Series 208 Epoxoprime MVT: www.tnemec.com/#sle.
- f. Mapei; Planiseal MSP: www.mapei.com.
- g. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

- A. Perform following operations in the order indicated:
 - 1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
 - a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
 - b. Removal of existing floor covering.
 - 2. Preliminary cleaning.
 - 3. Moisture vapor emission tests; one in the first 1000 square feet (100 square meters) and one test in each additional 20,000 square feet (1,858 square meters), unless otherwise indicated or required by flooring manufacturer.
 - 4. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - 5. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - 6. Specified remediation, if required.
 - 7. Patching, smoothing, and leveling, as required.
- B. Remediations:
 - 1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.

3.02 REMOVAL OF EXISTING FLOOR COVERINGS

- A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.
- B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.03 PRELIMINARY CLEANING

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents or other chemicals for cleaning.

3.04 MOISTURE VAPOR EMISSION TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Test in accordance with ASTM F1869 and as follows.
- C. Report: Report the information required by the test method.

3.05 INTERNAL RELATIVE HUMIDITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Test in accordance with ASTM F2170 Procedure A and as follows.
- C. Report: Report the information required by the test method.

3.06 ALKALINITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
- C. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
- D. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch (25 mm) in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.

3.07 PREPARATION

- A. **General Contractor to prepare the sub-floor under Carpet and Tile Carpeting as follows:**
 - 1. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.
 - 2. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.
 - 3. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
 - 4. Vacuum clean substrate.
- B. **General Contractor to prepare the sub-floor under Resilient Flooring as follows:**
 - 1. Inspect the slab with a 10 feet (3 m) straight edge in two directions. Fill low spots greater than 3/16 inch (4.7 mm) with sub-floor filler. Remove high spots greater than 3/16 inch (4.7 mm).
 - 2. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
 - 3. Scrape and sand the floor with #12 grit sand paper.
 - 4. Fill holes, chips and imperfections with sub-floor filler.
 - 5. Sand the floor again.
 - 6. Skim the floor with floor patch.
 - 7. Sand the floor again.
 - 8. Fill holes, chips and imperfections with sub-floor filler.
 - 9. **Floor installer to prepare the sub-floor surface after the General Contractor work is complete and as follows:**
 - a. Sand the floor.
 - b. Fill holes, chips and imperfections with sub-floor filler.
 - c. Vacuum clean substrate.
- C. See individual floor covering section(s) for additional requirements.

3.08 APPLICATION OF REMEDIAL FLOOR COATING

- A. Comply with requirements and recommendations of coating manufacturer.

- B. Apply coating under vinyl or rubber flooring.

END OF SECTION

SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Cementitious backing board.
- E. Gypsum wallboard.
- F. Joint treatment and accessories.
- G. Bullet resistant sheathing and wallboard.

1.02 RELATED REQUIREMENTS

- A. Section 05 40 00 - Cold-Formed Metal Framing: Exterior wind-load-bearing metal stud framing.
- B. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.
- C. Section 07 21 00 - Thermal Insulation: Acoustic insulation.
- D. Section 07 84 00 - Firestopping: Top-of-wall assemblies at fire rated walls.
- E. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
- F. Section 09 30 00 - Tiling: Tile backing board.

1.03 REFERENCE STANDARDS

- A. ANSI A108.11-SystemDeleted - American National Standard for Interior Installation of Cementitious Backer Units; 2010 (Revised).
- B. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- D. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.
- E. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.
- F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.
- G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.
- H. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.
- I. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.
- J. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.

- K. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2013.
- L. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2007a (Reapproved 2011).
- M. ASTM C1325 - Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units; 2014.
- N. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.
- O. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2015.
- P. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2013.
- Q. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.
- R. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- S. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.
- T. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.
- U. ASTM E413 - Classification for Rating Sound Insulation; 2010.
- V. GA-216 - Application and Finishing of Gypsum Board; 2013.
- W. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association; 2008.
- X. GA-600 - Fire Resistance Design Manual; 2015.
- Y. ITS (DIR) - Directory of Listed Products; current edition.
- Z. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.
- AA. UL 752 - Standard for Bullet-Resisting Equipment; Current Edition, Including All Revisions.
- AB. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
- C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- D. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.
- E. Test Reports: Bullet resistant sheathing and wallboard.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum three years of experience.
- B. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by, and displaying a classification

label from, an independent testing agency acceptable to the authority having jurisdiction.

1. Construct fire-resistance rated partitions in compliance with tested assembly requirements indicated on drawings and the code plan.

1.06 DELIVERY, STORAGE AND PROTECTION

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.
- B. Protect metal corner beads and trim from being bent or damaged.
- C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

1.07 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
 1. See PART 3 for finishing requirements.
- B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
 1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Fire Rated Assemblies: Provide completed assemblies as indicated on the drawings and the code plan.

2.02 METAL FRAMING MATERIALS

- A. Manufacturers - Metal Framing, Connectors, and Accessories:
 1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
 2. Marino: www.marinoware.com.
 3. Phillips Manufacturing Company: www.phillipsmfg.com.
 4. The Steel Network: www.steelnetwork.com.
 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (L/240 at 240 Pa).
 1. Coatings: Comply with ASTM C645; roll-formed from hot-dipped galvanized steel; complying with ASTM A1003/A1003M and ASTM A653/A653M G40 (Z120). A40 Galvannealed coatings and G40e coatings are not allowed.
 2. Minimum Base-Metal Thickness:
 - a. Steel Studs and Runners:
 - 1) 25 gauge 0.018 inch (0.45 mm), except 20 gauge 0.033 inch (0.84 mm) for door and window jambs, 18 gauge [0.030] inch at interior stud walls with masonry veneer.

- C. Studs: "C" shaped with flat or formed webs with knurled faces.
 - 1. Runners: U shaped, sized to match studs.
 - 2. Ceiling Channels: C-shaped.
 - 3. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
- D. Loadbearing Studs for Application of Gypsum Board: As specified in Section 05 40 00.
- E. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
- F. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
- G. Ceiling Suspension Systems:
 - 1. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062 inch (1.59 mm) diameter wire.
 - 2. Hanger Attachments to Concrete: Powder-Actuated Fasteners or anchors fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers.
 - 3. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 12 gauge 0.08 inch (2.05 mm) in diameter. Provide minimum 8 gauge 0.128 inch (3.26 mm) wire where ceiling membrane weighs 4 psf (191 Pa) or more.
 - 4. Carrying Channels: Cold-Formed, commercial-steel sheet with with a base-metal thickness of 0.053 inch (1.34 mm) and minimum 1/2 inch (13 mm) wide flanges, depth as indicated.
 - 5. Furring Members: Hat-shaped, rigid furring channels: ASTM C645, 7/8 inch (22 mm) deep. Cold-Formed Channels: 0.053 inch (1.34 mm) uncoated-steel thickness, 3/4 inch (19 mm) deep. Steel Studs and Runners: ASTM C645.
- H. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock, fire-rated type where required.
 - 1. Manufacturers:
 - a. Armstrong World Industries, Inc; Drywall Grid Systems: www.armstrong.com.
 - b. Chicago Metallic Corporation; Drywall Grid System: www.chicagometallic.com.
 - c. USG Corporation; Drywall Suspension System: www.usg.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 - 1. American Gypsum Company: www.americangypsum.com.
 - 2. CertainTeed Corporation: www.certainteed.com.
 - 3. Georgia-Pacific Gypsum: www.gpgypsum.com.
 - 4. National Gypsum Company: www.nationalgypsum.com.
 - 5. USG Corporation: www.usg.com.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Use for vertical surfaces, ceilings, and soffits, unless otherwise indicated.
 - 2. Type: Fire-resistance rated Type X, UL (DIR) or ITS (DIR) listed.
 - 3. Thickness:
 - a. Vertical Surfaces: 1/2 inch (13 mm).
 - b. Ceilings: 5/8 inch (16 mm).
 - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.

4. Edges: Tapered.
- C. Impact Resistant Wallboard:
 1. Application: High-traffic areas indicated.
 2. Surface Abrasion: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
 3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
 4. Soft Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
 5. Hard Body Impact: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
 6. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 7. Paper-Faced Type: Gypsum wallboard as defined in ASTM C1396/C1396M.
 8. Unfaced Type: Interior fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M.
 9. Type: Fire resistance rated Type X, UL (DIR) or ITS (DIR) listed.
 10. Thickness: 5/8 inch (16 mm).
 11. Edges: Tapered.
- D. Backing Board For Brick Veneer Areas:
 1. Application: Surfaces behind brick.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9-SystemDeleted or ASTM C1325.
 - a. Thickness: 5/8 inch (16 mm).
 - b. Type: Fire-resistance rated Type X, UL (DIR) or ITS (DIR) listed.
 - c. Products:
 - 1) Custom Building Products; Wonderboard: www.custombuildingproducts.com/#sle.
 - 2) National Gypsum Company; PermaBase Cement Board: www.nationalgypsum.com/#sle.
 - 3) USG Corporation; Durock Brand Cement Board: www.usg.com/#sle.
 - 4) Substitutions: See Section 01 60 00 - Product Requirements.
 4. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
 - a. Standard Type: Thickness 5/8 inch (16 mm).
 - b. Products:
 - 1) Georgia-Pacific Gypsum; DensShield Tile Backer.
 - 2) National Gypsum Company; Gold Bond eXP Tile Backer.
 - 3) Certainteed Corporation; Diamondback GlasRoc Tile Backer.
 - 4) USG Corporation; Durock Brand Galss-Mat Tile Backerboard: www.usg.com..
 - 5) Substitutions: See Section 01 60 00 - Product Requirements.
- E. Bullet Resistant Sheathing and Wallboard: Woven roving, multi-ply, ballistic grade fiberglass cloth with thermoset polyester resin; comply with UL 752 Level 4.
- F. Exterior Sheathing Board: As specified in Section 06 10 00.
- G. Shaftwall and Coreboard: Type X; 1 inch (25 mm) thick by 24 inches (610 mm) wide, beveled long edges, ends square cut.
 1. Paper Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.

2. Glass Mat Faced Type: Glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel as defined in ASTM C1658/C1658M.

2.04 ACCESSORIES

- A. Acoustic Insulation: As specified in Section 07 21 00.
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
 1. Products:
 - a. Franklin International, Inc; Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: www.titebond.com/#sle.
 - b. Tremco Acoustical Sealant; Tremco Inc.: www.tremcosealants.com.
 - c. Sheetrock Brand Acoustical Sealant; USG Corporation: www.usg.com.
 - d. SCS-100; ITW TACC: www.itwacc.com.
 - e. AC-20 FTR; Pecora Corporation: www.pecora.com.
- C. Finishing Accessories: ASTM C1047, galvanized steel, unless noted otherwise.
 1. Types: As detailed or required for finished appearance.
 2. Special Shapes: In addition to conventional corner bead and control joints, provide L-bead at exposed panel edges.
- D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 1. Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners.
 2. Ready-mixed vinyl-based joint compound.
 3. Chemical hardening type compound.
- E. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.
- F. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion resistant.
- G. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 PREPARATION

- A. Applied Fireproofing: Before applied fireproofing materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed applied fireproofing materials. Where offset anchor plates are required, provide continuous plates fastened to building structure. Do not reduce thickness of applied fireproofing materials below that required for fire-resistance ratings indicated. Protect adjacent applied fireproofing materials from damage.
- B. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

3.03 GENERAL

- A. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

- B. Do not bridge building expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.
- C. Install bracing at terminations in assemblies.

3.04 SHAFT WALL INSTALLATION

- A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
 - 1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches (600 mm) on center.
 - 2. Install studs at spacing required to meet performance requirements.
- B. Shaft Wall Liner: Cut panels to accurate dimension and install sequentially between special friction studs.
 - 1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
 - 2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.05 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Ceilings Support Suspension Systems:
 - 1. Secure wire hangers to structural support by looping and wire tying, connecting directly to structural member where possible or provide additional framing as required. At concrete decks connect to inserts, clips or eyelets. Do not attach to the metal deck or permanent metal forms.
 - 2. Space main runners 48 inch (1219.2 mm) o.c. maximum and space hangers 48 inch (1219.2 mm) o.c. maximum along runners, except as otherwise shown.
 - 3. Level main runners to a tolerance of 1/1200, measured both lengthwise on each runner and transversely between parallel runners.
 - 4. Wire-tie or clip furring members to main runners and to other structural supports as indicated.
 - 5. Space furring member at 16 inch (406.4 mm) o.c., except as otherwise indicated.
 - 6. Install auxiliary framing at termination of drywall work, and at openings for light fixtures and similar work, as required for support of both the drywall construction and other work indicated for support thereon.
- C. Studs: Space studs as scheduled.
 - 1. Extend partition framing to above ceiling or to deck where scheduled.
 - 2. Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.
 - 3. Install runner tracks at floors, ceilings, tops of walls, and structural walls and columns where gypsum drywall stud system abuts other work, except as otherwise indicated.
 - 4. Laterally brace top of studs at 4 foot (1.2 m) o.c. if partition does not extend to overhead structure.
 - 5. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
 - 6. Construct framing around plumbing fixture carriers spacing studs as necessary to fit and maintain structural integrity of the studs.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
 - 1. Erect framing for door and sidelight frames plumb.
 - 2. Frame openings with minimum base-metal thickness of 0.033 inch (0.838 mm) for double jambs and head.

3. Frame duct and similar openings to within 1/4 inch (6.3 mm) of required size allowing for isolation between framing and penetrating member.
- E. Standard Wall Furring: Install at concrete and masonry walls scheduled to receive furring and gypsum board, not more than 4 inches (100 mm) from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches (600 mm) on center.
 1. Orientation: Horizontal.
 2. Spacing: At 16 inches (400 mm) on center.
 3. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.06 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions. Install where acoustic walls are scheduled.
 1. Place one bead continuously on substrate before installation of perimeter framing members.
 2. Place continuous bead at perimeter of each layer of gypsum board.
 3. Seal around all penetrations by conduit, pipe, ducts, rough-in boxes, and control and expansion joints, except where firestopping is provided.
 - a. Apply at least 1/8 inch (3.1 mm) coating of acoustic sealant on sides and back of rough-in boxes.
 - b. Acoustic sealant work includes sealing above acoustical ceilings.
 - c. Install acoustical sealant at both faces of partitions at penetrations.

3.07 BOARD INSTALLATION

- A. Comply with ASTM C840 and GA-216. Install to minimize butt end joints, especially in highly visible locations.
 1. Do not place tapered edges against cut edges or ends.
 2. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) open space between boards. Do not force into place.
 3. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.
 4. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4 inch (6.3 mm) space and trim edge with L-type edge trim. Seal joints with acoustical sealant at sound-rated walls and where indicated.
 5. Fit board to ducts, pipes, outlets, etc., which are penetrating wallboard. Seal joints with acoustical sealant at sound-rated walls and where indicated.
- B. Single-Layer Non-Rated: Install gypsum board vertically, with ends and edges occurring over firm bearing.
 1. At tall and narrow walls, install boards horizontally with end joints minimal and staggered over studs to minimize joints.
- C. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- D. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

- E. Cementitious Backing Board: Install over steel framing members where indicated, in accordance with ANSI A108.11-System Deleted and manufacturer's instructions.
- F. Ceilings: Install ceiling boards in the direction and manner which will minimize the number of end-butt joints, and which will avoid end joints in the central area of each ceiling.
- G. Installation on Framing: Use screws for attachment of all gypsum board .
 - 1. Space fasteners in gypsum boards in accordance with referenced standards and manufacturer's recommendations, except as otherwise indicated.
- H. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.
- I. Bullet Resistant Sheathing and Wallboard:
 - 1. Install bullet resistant sheathing according to manufacturer's written recommendations and with manufacturer approved fasteners.
 - 2. Cover all joints between boards with a 4 inch (102 mm) strip of the same thickness material as the boards, centered on the joint.

3.08 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials, would otherwise be exposed or not covered with other trim.

3.09 JOINT TREATMENT

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.
- B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed or powder-type vinyl-based joint compound and finished with ready-mixed or powder-type vinyl-based joint compound.
- C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 2. Level 2: Behind cabinetry, and on backing board to receive tile finish.
 - 3. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.
- D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
 - 2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
 - 3. Taping, filling and sanding is not required at base layer of double layer applications.
- E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.10 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

3.11 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION

SECTION 09 51 00 - ACOUSTICAL CEILINGS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Placement of special anchors or inserts for suspension system.
- B. Section 05 31 00 - Steel Decking: Placement of special anchors or inserts for suspension system.
- C. Section 07 21 00 - Thermal Insulation: Acoustical insulation.

1.03 REFERENCE STANDARDS

- A. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).
- B. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.
- C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
- D. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements; 2015.
- E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.
- F. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.
- G. UL (FRD) - Fire Resistance Directory; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on suspension system components and acoustical units.
- C. Samples: Submit two samples 6 by 6 inch (152 by 152 mm) in size illustrating material and finish of acoustical units.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Provide 12 units of each type of acoustical tile used at date of Substantial Completion.

1.06 QUALITY ASSURANCE

- A. Fire-Resistive Assemblies: Complete assembly listed and classified by UL (FRD) for the fire resistance indicated.

- B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.
- C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.07 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.
- B. Prior to the start of installation, all exterior windows and doors are to be in place, glazed and weather-stripped. The roof is to be watertight, and all wet trades' work is to be completed, and thoroughly dry. Mechanical, electrical and other utility service work installations above the ceiling plane shall have been completed. No materials should rest against, or wrap around, the ceiling suspension components or connecting hangers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc: www.armstrong.com.
 - 2. CertainTeed Corporation: www.certainteed.com.
 - 3. USG: www.usg.com.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Suspension Systems:
 - 1. Same as for acoustical units.

2.02 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
 - 1. Units for Installation in Fire-Rated Suspension System: Listed and classified for the fire-resistive assembly as part of suspension system.
- B. Acoustical Panels Type A9: Painted mineral fiber, ASTM E 1264 Type III, with the following characteristics:
 - 1. Size: 24 x 24 inches (600 x 600 mm).
 - 2. Thickness: 3/4 inches (19 mm).
 - 3. Fire Rating Assembly: Non-rated.
 - 4. NRC Range: .70, determined as specified in ASTM E1264.
 - 5. Ceiling Attenuation Class (CAC): 35 minimum, determined as specified in ASTM E1264.
 - 6. Edge: Square.
 - 7. Surface Color: White.
 - 8. Basis of Design: Fine Fissured by Armstrong World Industries.
 - a. Substitutions: Refer to Section 01 60 00 - Product Requirements.
 - b. Other products of other manufacturers as listed above will be considered provided the overall performance is within the specified range(s) and the overall appearance is not significantly different from that of the specified product.
 - c. SJCF's decision on substitutions is final.
- C. Metal Panels Type A9D: 24 ga cold rolled electrogalvanized steel.
 - 1. Size: 24 x 24 inches (600 x 600 mm).
 - 2. Edge: Raised Bead (continuous all four sides)
 - 3. Face: Perforated
 - 4. Finish: Two coats baked enamel polyester paint.
 - 5. Surface Color: White.

6. Basis of Design: Steel Panels - Snap-in by Steel Ceilings, Inc.

2.03 SUSPENSION SYSTEM(S)

- A. Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
 - 1. Provide curved or segmented and curved wall angles at radius walls and round or radius columns.
 - 2. Provide trimable corner pieces to match bullnose profile at radius wall corners.
 - 3. Entry Vestibules: Provide hold down clips and access clips.
 - 4. Fire Rating: Provide hold down clips and access clips where system requires them for fire rating.
- B. Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; intermediate-duty.
 - 1. Profile: Tee; 15/16 inch (24 mm) wide face.
 - 2. Construction: Double web.
 - 3. Finish: White painted.
- C. Concealed Grid - Channel Hung Type MP: Cold Rolled steel (black iron).
 - 1. 1 1/2" cold rolled furring channel (black iron).
 - 2. 1 1/2" x 1 5/8" deep galvanized steel tee bar

2.04 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, Direct Hung, unless otherwise indicated.
 - 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E488/E488M or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.
 - 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E1190, conducted by a qualified testing and inspecting agency.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C635/C635M, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 12 gauge, 0.08 inch (2.05 mm) diameter wire.
 - 3. At Indoor Swimming Pools and at Aluminum Suspension Systems: Nickel-Copper alloy wire, 12 gauge, 0.08 inch (2.05 mm) diameter wire; epoxy coated concrete deck fasteners; tape between wire and aluminum grid to prevent galvanic action of dissimilar materials.
 - a. Manufacturer:
 - 1) Special Metals Corporation; Monel alloy 400: www.specialmetals.com.
 - 2) Substitutions: See Section 01 60 00 - Product Requirements.
- D. Perimeter Moldings: Same material and finish as grid.

1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
 2. At Concealed Grid: Provide exposed L-shaped molding.
- E. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.
- F. Touch-up Paint: Type and color to match acoustical and grid units.
- G. Sound Insulation above metal panels: refer to 07 21 00 Thermal Insulation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C 636/C 636M and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Locate system on room axis according to reflected ceiling plan or lighting layout.
- D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Attachment of hangers:
1. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 2. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
- G. **Do not support ceilings directly from permanent metal forms or floor deck.** Fasten hangers to structural members, cast-in-place hanger inserts, postinstalled mechanical anchors, or power-actuated fasteners that extend through forms into concrete.
- H. **Do not support ceiling directly from steel roof deck.** Attach hangers to structural members.
- I. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental framing support for attachment of hanger wires.
- J. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental framing members and hangers in form of trapezes or equivalent devices.

- K. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- L. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently.
- M. Do not eccentrically load system or induce rotation of runners.
- N. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
 - 2. Overlap corners.
 - 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- O. Install light fixture boxes constructed of acoustical panel above light fixtures in accordance with fire rated assembly requirements and light fixture ventilation requirements.
- P. Concealed Grid - Intersecting exposed members notched or formed and spliced to form flush surfaces. 1 1/2" cold rolled channels at 4'-0" O.C. maximum with tee bars at 2'-0" o.c. Use channel shape wall moulding to receive cut panel edge.

3.03 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install units after above-ceiling work is complete.
- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. Cutting Acoustical Units:
 - 1. Make field cut edges of same profile as factory edges.
- G. Where round obstructions and bullnose concrete block corners occur, provide preformed closures to match perimeter molding.
- H. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.
- I. Install security clips at metal panel ceilings. Install wall moulding hold-down clips where edge of panel has been cut. Once clip for each 12" of cut panel edge required.
- J. Install wire pad supports on top of panel prior to installing insulation pad.

3.04 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.05 CLEANING

- A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 65 00 - RESILIENT FLOORING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Resilient tile flooring.
- B. Static control resilient tile flooring.
- C. Resilient base.
- D. Installation accessories.
- E. At concrete wall panels, the Contractor shall grout fill vertical joints at the concrete wall panels behind where the base is applied.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.
- B. Section 03 54 00 - Cast Underlayment.
- C. Section 09 05 61 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.
- D. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Grounding and bonding of static control flooring to building grounding system.

1.03 REFERENCE STANDARDS

- A. AIA A305 - Contractor's Qualification Statement; 1986.
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
- C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2014).
- D. ASTM F1700 - Standard Specification for Solid Vinyl Tile; 2013a.
- E. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).
- F. ASTM F2169 - Standard Specification for Resilient Stair Treads; 2015.
- G. ASTM F2195 - Standard Specification for Linoleum Floor Tile; 2013.
- H. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; October 2011.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Selection Samples: Submit manufacturer's complete set of color samples for SJCF's initial selection.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Flooring Material: 5 square feet (0.5 square meters) of each type and color.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum 5 years of documented experience.

- B. Installers: Each Installer must comply with all requirements of the Specifications and Drawings. Approved installers for this project are as follows:

CAP Carpet, Inc.
Carpet Value
Country Carpet, Inc.
Fortney Tile & Flooring Company, Inc.
Interior Surface Enterprises, LLC
Kansas Carpet & Tile Inc.
Manhattan Carpet & Interiors, Inc.
Star Lumber & Supply Co., Inc.
Stuart & Associates
Vitztum Commercial Flooring, Inc.

1. SJCF may approve additional Installers for this project based on proximity to the project site, work ethic, relevant project experience and company information. Installers seeking approval for this project shall submit AIA A305, Contractor's Qualification Statement to SJCF. Requests must be received ten days prior to bid date.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).
- D. Protect roll materials from damage by storing on end.
- E. Do not double stack pallets.
- F. Store floor tiles on flat surfaces.

1.07 FIELD CONDITIONS

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.01 TILE FLOORING

- A. Vinyl Composition Tile: Homogeneous, with color extending throughout thickness.
1. Manufacturers:
- a. Armstrong World Industries, Inc; Standard Excelon Imperial Texture: www.armstrong.com.
- b. Substitutions: See Section 01 60 00 - Product Requirements.
2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
3. Size: 12 by 24 inch (305 by 610 mm).
4. Thickness: 0.125 inch (3.2 mm).
5. Color: To be selected by SJCF from manufacturer's full range. Provide (2) colors, 50% of each.
6. Pattern: 1/3 offset brick pattern.
- B. Static Control Tile: Homogeneous; color and pattern throughout thickness.
1. Manufacturers:
- a. Roppe; www.roppe.com.

2. Minimum Requirements: Solid vinyl tile complying with ASTM F1700, Class 1, Type A.
3. Electrical Resistance:
 - a. Dissipative Tile: Resistance between 1.0 megohms and 1000 megohms as tested in accordance with ASTM F150.
4. Tile Size: 12 by 12 inch (305 by 305 mm).
5. Total Thickness: 0.125 inch (3 mm).
6. Product: ESD Vinyl Tile.
7. Color: To be selected by SJCF from manufacturer's full range.

2.02 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
 1. Manufacturers:
 - a. Burke Flooring: www.burkeflooring.com/#sle.
 - b. Johnsonite, a Tarkett Company: www.johnsonite.com.
 - c. Roppe Corp: www.roppe.com.
 - d. Flexco, Inc.: www.flexcofloors.com.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Height: 4 inch (100 mm).
 3. Thickness: 0.125 inch (3.2 mm).
 4. Finish: Satin.
 5. Length: Roll.
 6. Color: To be selected by SJCF from manufacturer's full range.
 7. Accessories: Premolded external corners where the return is less than 6 inch (152 mm).

2.03 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Adhesive for Vinyl and Rubber Flooring:
 1. Suitable for slabs with moisture vapor emission rates (MVERs) up to 8 lbs per 1,000 sq. ft. (3.63 kg per 92.9 m squared) per 24 hours and 90% relative humidity.
 2. Manufacturers:
 - a. Stauf USA, LLC; D737 High-Tack: www.staufusa.com/#sle.
 - b. TEC, an H.B. Fuller Construction Products Brand; TEC Roll Fast Vinyl Flooring Adhesive: www.tecspecialty.com/#sle.
 - c. Mapei; Ultrabond ECO 711: www.mapei.com.
 - d. Substitutions: Section 01 60 00 - Product Requirements.
- D. Moldings, Transition and Edge Strips: Rubber or vinyl.
 1. Install at the following locations:
 - a. Edge between resilient tile and exposed concrete - Johnsonite RRS-XX-D or equal.
 - b. Molding between carpet and resilient tile - Johnsonite CD-XX-B or equal.
 - c. Stair nosing with visually impaired strip with resilient tile at stairs/risers - Johnsonite VIRCEN-XX-B or equal.
 - d. Others where detailed or required.
- E. Copper Grounding Strips: Type and size as recommended by static control flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
 - 1. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by manufacturer.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.
- B. **General Contractor to prepare the sub-floor surface as follows:**
 - 1. Inspect the slab with a 10 feet (3 m) straight edge in two directions. Fill low spots greater than 3/16 inch (4.7 mm) with sub-floor filler. Remove high spots greater than 3/16 inch (4.7 mm).
 - 2. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
 - 3. Scrape and sand the floor with #12 grit sand paper.
 - 4. Fill holes, chips and imperfections with sub-floor filler.
 - 5. Sand the floor again.
 - 6. Skim the floor with floor patch.
 - 7. Sand the floor again.
 - 8. Fill holes, chips and imperfections with sub-floor filler.
- C. **Floor installer to prepare the sub-floor surface after the General Contractor work is complete and as follows:**
 - 1. Sand the floor.
 - 2. Fill holes, chips and imperfections with sub-floor filler.
- D. Prohibit traffic until filler is fully cured.
- E. Clean substrate.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Spread only enough adhesive to permit installation of materials before initial set.
- D. Place copper grounding strip in conductive adhesive and apply additional adhesive to top side of strip before installing static control flooring. Allow strip to extend beyond flooring in accordance with static control flooring manufacturer's instructions. Refer to Section 26 05 26 for grounding and bonding to building grounding system.
- E. Fit joints and butt seams tightly.
- F. Set flooring in place, press with heavy roller to attain full adhesion.
- G. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

- H. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
 - 1. Resilient Strips: Attach to substrate using adhesive.
- I. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- J. At movable partitions, install flooring under partitions without interrupting floor pattern.
- K. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

3.04 INSTALLATION - TILE FLOORING

- A. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).
- B. In-so-far as possible, use materials from one number run. If quantity of material requires more than one run, only tile from one run shall be used in any one room or area.
- C. Do not mix flooring from different runs in the same room or area.

3.05 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
- B. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

3.06 INSTALLATION - STAIR COVERINGS

- A. Install stair coverings in one piece for full width and depth of tread.
- B. Install stringers configured tightly to stair profile.
- C. Adhere over entire surface. Fit accurately and securely.

3.07 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.
- C. Leave areas broom clean. Waxing shall be by the Owner.

3.08 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 67 00 - FLUID-APPLIED FLOORING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Fluid-applied flooring and base.

1.02 REFERENCE STANDARDS

- A. ASTM D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser; 2014.
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
- C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available .
- C. Samples for Initial Selection: For each type of exposed finish required.
- D. Samples for Verification: After color and texture is selected, for each resinous flooring system required, 8 x 8 inch (203 x 203 mm) square, applied to a rigid backing by Installer for this Project.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section.
 - 1. Minimum five years of documented experience.
 - 2. Approved by manufacturer.

1.05 MOCK UP

- A. Construct mock-up(s) of fluid applied flooring to serve as basis for evaluation of texture and workmanship.
 - 1. Number of Mock-Ups to be Prepared: One for each flooring system specified.
 - 2. Use same materials and methods for use in the work.
 - 3. Locate where directed.
 - 4. Minimum Size: 2 feet by 2 feet.
- B. Obtain approval of mock-up by SJCF before proceeding with work.
- C. Approved mock-up may remain as part of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store resin materials in a dry, secure area.
- B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.07 FIELD CONDITIONS

- A. Maintain minimum temperature in storage area of 55 degrees F (13 degrees C).

- B. Store materials in area of installation for minimum period of 24 hours prior to installation.
- C. Maintain ambient temperature required by manufacturer 48 hours prior to, during, and 48 hours after installation of materials.
- D. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

1.08 WARRANTY

- A. Provide a one year warranty signed by the manufacturer and installer warranting that the resinous floor system will be free from defects including debonding, regionalized discoloration and excessive wear. Warranty shall include removal and replacement if defective.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Fluid-Applied Flooring 'E1': Epoxy base coat(s) with broadcast quartz aggregate.
 - 1. Thickness: 3/16 inch (5 mm), nominal, when dry.
 - 2. Texture: Smooth.
 - 3. Sheen: Satin / Semi-gloss.
 - 4. Color: As selected by SJCF.
 - 5. Cove: 6 inch cove base with 1 inch radius where scheduled.
 - 6. Products:
 - a. Stonhard: www.stonhard.com
 - 1) Base Coat: Stonshield HRI Base. Four component, troweled mortar base consisting of epoxy resin, curing agent and finely graded silica aggregate.
 - 2) Undercoat: Stonshield Undercoat. Three component, free flowing epoxy formulation consisting of resin, curing agent, pigment and fine aggregate.
 - 3) Aggregate: Stonshield Aggregate. Brightly colored, quartz broadcast aggregate.
 - 4) Top Coats: Two coats Stonkote CE4. Two-component, high solids, clear epoxy sealer.
 - b. Tennant Co.: www.tennantco.com
 - 1) Primer: Eco-MPE
 - 2) Base Coat: Eco-PT 250 with PT topcoat
 - 3) Broadcast Coat: Eco-MPE with colored quartz broadcast
 - 4) Grout/Seal Coat: Eco-URE-OP
 - 5) Next Coat: Eco-CRE
 - 6) Topcoat: Eco-HTS 100
 - c. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

- A. Base Caps, and Separator Strips: Match divider strips, with projecting base of 1/8 inch (3 mm).
- B. Fillet Strips: Molded material compatible with flooring.
- C. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive flooring.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of materials to sub-floor surfaces.
- D. Verify that concrete sub-floor surfaces are ready for flooring installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within the following limits:
 - 1. Moisture emission rate: Not greater than 3 lb per 1000 sq ft (7.1 kg per 100 sq m) per 24 hours, tested according to ASTM F1869.
 - 2. Alkalinity: pH range of 5 to 9, tested according to ASTM F710.
 - 3. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement or as recommended by manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Effectively remove concrete laitance on accessible floor surfaces by mechanical shot blast. Acid etching is not acceptable.
- B. Areas where flooring is existing must be cleaned to remove all floor material, grease or any residue that might retard interfacial adhesion between substrate and surfacing.
- C. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with sub-floor filler.
- D. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.
- E. Control Joints: Fill control joints with an approved elastomeric sealant or a semi-rigid epoxy joint filler or a two component epoxy and filler.
- F. Expansion Joints: Terminate flooring at each side of joint. Apply sealant after flooring is complete.
- G. Vacuum clean substrate.
- H. Apply primer to surfaces required by flooring manufacturer.

3.03 INSTALLATION - FLOORING

- A. Apply in accordance with manufacturer's instructions.
- B. Apply each coat to minimum thickness required by manufacturer.
- C. Finish to smooth level surface.
- D. Architect shall have final approval of texture of finish in each area.

3.04 PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.
- B. Barricade area to protect flooring until fully cured.

END OF SECTION

SECTION 09 68 00 - CARPETING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Carpet, direct-glued.

1.02 RELATED REQUIREMENTS

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied carpet.
- C. Section 09 05 61 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.
- D. Section 09 68 13 - Tile Carpeting.

1.03 REFERENCE STANDARDS

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2006 (Reapproved 2011).
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
- D. CRI 104 - Standard for Installation of Commercial Carpet; 2015.
- E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Manufacturer's Installation Instructions: Indicate special procedures.
- D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional requirements.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum three years documented experience. Reference 09 68 13 Carpet Tile for approved installers.

1.06 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.
- B. Maintain minimum 70 degrees F (21 degrees C) ambient temperature 24 hours prior to, during and 24 hours after installation.

PART 2 PRODUCTS**2.01 CARPET**

- A. Field Carpet:

1. Product: I0164 Big Splash manufactured by Patcraft.
 2. Roll Width: 12 ft (3658 mm).
 3. Color: Dive-Sheet 00418.
 4. Backing: Ultraloc.
- B. Accent Carpet:
1. Product: I0203 Color Choice manufactured by Patcraft.
 2. Roll Width: 12 ft (3658 mm).
 3. Color: Deep Navy 00485.
 4. Backing: Ultraloc.
 5. Pattern: Reference finish schedule for locations.

2.02 ACCESSORIES

- A. Sub-Floor Filler: Type recommended by carpet manufacturer.
- B. Adhesives:
1. Compatible with materials being adhered; maximum VOC content as specified in Section 01 61 16.
- C. Seam Adhesive: Recommended by carpet manufacturer.
- D. Carpet Adhesive: Recommended by carpet manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesives to sub floor surfaces.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install carpet and cushion in accordance with manufacturer's instructions and CRI 104 (Commercial).
- C. Verify carpet match before cutting to ensure minimal variation between dye lots.
- D. Lay out carpet and locate seams in accordance with shop drawings.
1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
 2. Do not locate seams perpendicular through door openings.
 3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
 4. Locate change of color or pattern between rooms under door centerline.
 5. Provide monolithic color, pattern, and texture match within any one area.
- E. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

3.04 DIRECT-GLUED CARPET

- A. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to cut edges of woven carpet immediately.
- B. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.
- C. Apply seam adhesive to the base of the edge glued down. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.
- D. Roll with appropriate roller for complete contact of adhesive to carpet backing.
- E. Trim carpet neatly at walls and around interruptions.

3.05 CLEANING

- A. Remove excess adhesive from floor and wall surfaces without damage.
- B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 68 13 - TILE CARPETING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Carpet tile, fully adhered.
- B. Accessories

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.
- B. Section 09 05 61 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

1.03 REFERENCE STANDARDS

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2006 (Reapproved 2011).
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
- D. CRI 104 - Standard for Installation of Commercial Carpet; 2015.
- E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Manufacturer's Installation Instructions: Indicate special procedures.
- D. Maintenance Data for Closeout Submittals: For carpet to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Carpet Tiles: 20 sq ft (1.8 sq m) of each color and pattern installed.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years experience.
- B. Installers: Each Installer must comply with all requirements of the Specifications and Drawings. Approved installers for this project are as follows:
 - CAP Carpet, Inc.
 - Carpet Value
 - Country Carpet, Inc.
 - Fortney Tile & Flooring Company, Inc.
 - Fox Ceramic Tile, Inc.
 - Interior Surface Enterprises, LLC
 - Kansas Carpet & Tile Inc.

Manhattan Carpet & Interiors, Inc.
Star Lumber & Supply Co., Inc.
Stuart & Associates
Vitztum Commercial Flooring, Inc.

1. SJCF may approve additional Installers for this project based on proximity to the project site, work ethic, relevant project experience and company information. Installers seeking approval for this project shall submit AIA Document A305, Contractor's Qualification Statement to SJCF. Requests must be received ten days prior to bid date.

1.06 FIELD CONDITIONS

- A. Do not install carpet until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- B. Store materials in area of installation for minimum period of 24 hours prior to installation.
- C. Maintain 65 to 90 deg F (18 to 32 deg C) ambient temperature with a maximum relative humidity of 65%, 48 hours prior to, during and 72 hours after installation.

PART 2 PRODUCTS

2.01 MATERIALS

The following carpet products are approved:

- A. Entry Carpet Tile 'M': _____
 1. Product: Walk Right In II manufactured by Patcraft.
 2. Installation Pattern: Quarter-Turn. Set parallel to building lines.
 3. Color: To be selected by SJCF from full range of manufacturer's colors.

2.02 ACCESSORIES

- A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Molding and Edge Strips: Rubber or vinyl, color as selected.
 1. Install at the following locations:
 - a. Edge between carpet and exposed concrete - Johnsonite EG-XX-K or equal.
 - b. Molding between carpet and resilient tile - Johnsonite CD-XX-B or equal
 - c. Stair nosing with visually impaired strip with carpet at radius stairs/risers- Johnsonite VIVCD-XX or equal.
 - d. Stair nosing with visually impaired strip with carpet at straight stairs/risers - Johnsonite VIRCEN-XX-A or equal.
 - e. Others where detailed or required.
- C. Adhesives:
 1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) certified; in lieu of labeled product, independent test report showing compliance is acceptable.
- D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer.
 1. Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.
 - 1. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions and CRI 104 (Commercial).
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Maintain dye lot integrity. Do not mix dye lots in same room or space.
- E. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- F. Locate change of color or pattern between rooms under door centerline.
- G. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- H. Trim carpet tile neatly at walls and around interruptions.
- I. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Remove and dispose of debris and unusable scraps.
- C. Replace carpet where damaged, flawed and can't be cleaned satisfactorily.
- D. Remove yarns that protrude from carpet surface.
- E. Clean and vacuum carpet surfaces.
- F. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period.

END OF SECTION

SECTION 09 69 00 - ACCESS FLOORING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Adjustable height access flooring systems.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Requirements for floor flatness and levelness.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.
- C. ASTM E2322 - Standard Test Method for Conducting Transverse and Concentrated Load Tests on Panels used in Floor and Roof Construction; 2003 (Reapproved 2015).
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- E. CISCA (AF) - Recommended Test Procedures for Access Floors; 2007.
- F. ICC (IBC) - International Building Code; 2015.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data sheets including loading capacities, materials, finishes, dimensions of components, profiles, and accessories.
- C. Shop Drawings: Indicate floor layout, appurtenances or interruptions, edge details, stairs.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Materials: Supply an additional 10 (ten) percent of access flooring system components.
 - 3. Panel Lifting Devices: One, of manufacturer's standard type.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the type of work required in this section and approved by access flooring manufacturer.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Access Flooring - Adjustable Height:
 - 1. Tate Access Floors, Inc; ____: www.tateaccessfloors.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 Performance REQUIREMENTS

- A. Concentrated Load: Over an area of 1 inch by 1 inch (25 mm by 25 mm), 1250 pounds (567 kg) at any location, when tested in accordance with Cisca (AF).
 - 1. Maximum Deflection: 0.04 inch (1 mm).
- B. Ultimate Load: Over an area of 1 inch by 1 inch (25 mm by 25 mm): Not less than twice design load or 2500 pounds (1134 kg), when tested in accordance with Cisca (AF).
- C. Rolling Loads: Permanent deformation not to exceed 0.04 inch (1 mm), when tested in accordance with Cisca (AF).
 - 1. Wheel A: 10 passes, with loading of 1000 pounds (454 kg).
 - 2. Wheel B: 10,000 passes, with loading of 800 pounds (363 kg).
- D. Drop Impact Load: 100 pounds (45.5 kg), when tested in accordance with Cisca (AF).
- E. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 75, maximum; when tested in accordance with ASTM E84.

2.03 ACCESS FLOORING - ADJUSTABLE HEIGHT

- A. Factory-fabricated system consisting of removable floor panels and supporting understructure that allows access to space below floor without requiring removal of panels other than the one directly above the space to which access is needed; provide components and accessories required for complete installation.
- B. Finished Floor Elevation: Top of access floor 18 inches (457 mm) nominal height above building structural floor.
- C. Configuration:
 - 1. Lay-in panels on bolted stringer understructure.
- D. Components:
 - 1. Pedestal Assembly:
 - a. Material: Steel.
 - b. Base: Manufacturer's standard shape and size in accordance with system performance requirements.
 - c. Column: Threaded supporting rod to permit 1 inch (25.4 mm) adjustment.
 - d. Head: Manufacturer's standard shape and size to accept specified configuration.
 - e. Maximum Pedestal Axial Load: 6000 pounds (2722 kg) without permanent deformation, when tested in accordance with Cisca (AF).
 - 2. Stringers: Steel channels, box, or tee sections.
 - a. Stringer Load: 450 pounds (204 kg), with a permanent set not to exceed 0.010 inch (0.254 mm), when tested in accordance with Cisca (AF).
 - 3. Floor Panels:
 - a. Construction:
 - 1) Composite board core with factory-applied finish, edge banding, and steel sheet bottom.
 - b. Factory-Applied Finish: LVT - as selected from manufacturer's standard finishes for panel type specified.

2.04 ACCESSORIES - ADJUSTABLE HEIGHT

- A. Fascia Panels: Laminated construction as follows:
 - 1. Front and Back Face Sheets: Aluminum sheet, ____ inch (____ mm) thick.
 - 2. Core: Plywood.
 - 3. Accessories: Include corner pieces, trim, reinforcing, and clip angles.
- B. Stairs: Same materials, structural strength and construction as floor panels with aluminum trim angle at nosing connected by pop rivet, aluminum fascia risers, 6" high.
- C. Railings: Posts and rails of extruded aluminum; assembled with welded connections; cast metal end caps, floor sockets, collars, brackets, and fittings.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify field measurements are as indicated on shop drawings.
- B. Verify that substrates comply with tolerances, dimensioned clearances, and other requirements specified in other sections, and that substrates are clean, dry, and free of conditions and deleterious substances that might interfere with system installation.
- C. Verify that required utilities are available, in proper location, and are ready for use.
- D. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION - Adjustable HEIGHT ACCESS FLOORING

- A. Install components in accordance with manufacturer's instructions.
- B. Secure pedestal base plate to subfloor with adhesive.
- C. Fascia Panels:
 - 1. Install fascia panels at exposed sides.
 - 2. Secure panels to clip angles attached to structural floor and edge of floor panels.
 - 3. Install metal trim at intersection of fascia panels and access floor and at abutting walls and columns.
- D. Railings:
 - 1. Extend railing posts through floor panels to structural floor; secure to flange fittings anchored to structural floor.
 - 2. Brace posts in position at floor panels with floor collar retainers.

3.03 TOLERANCES

- A. Maximum Out of Level Floor Panel Tolerance: 1/16 inch in 10 ft (1.6 mm in 3 m), non-cumulative.

3.04 ADJUSTING

- A. Adjust pedestals to achieve a level floor and to assure adjacent floor panel surfaces are flush.

3.05 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

3.06 PROTECTION

- A. Do not permit traffic over unprotected floor surface.

END OF SECTION

SECTION 09 91 13 - EXTERIOR PAINTING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
 - 1. General: Paint all exposed surfaces, except as otherwise indicated, whether or not colors are designated. If not designated, match adjacent painted surface; if not in a painted surface, in general match trim color.
 - 2. Exposed surfaces of steel lintels and ledge angles.
 - 3. Mechanical and Electrical:
 - a. Paint all exposed conduit, boxes and louvers which are not factory prefinished, unless otherwise indicated.
 - b. On the roof, paint all rooftop mechanical equipment, including that which is factory-finished.
 - c. Paint all exterior gas pipe including gas pipe on the roof.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Unless otherwise indicated, shop priming of ferrous metal items and fabricated components are included under their respective trades.
 - 3. Items indicated to receive other finishes.
 - 4. Items indicated to remain unfinished.
 - 5. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 6. Non-metallic roofing and flashing.
 - 7. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.
 - 8. Floors, unless specifically indicated.
 - 9. Brick, glass unit masonry, architectural concrete, precast concrete, cast stone, integrally colored plaster and stucco.
 - 10. Exterior insulation and finish system (EIFS).
 - 11. Glass.
 - 12. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Shop-primed items.
- B. Section 09 91 23 - Interior Painting.

1.03 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2005 (Reapproved 2012).
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, www.paintinfo.com.

- E. SSPC V1 (PM1) - Good Painting Practice: Painting Manual, Volume 1; Fourth Edition.
- F. SSPC V2 (PM2) - Systems and Specifications: Steel Structures Painting Manual, Volume 2; Fourth Edition.
- G. SSPC-SP 1 - Solvent Cleaning; 2015.
- H. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).
- I. SSPC-SP 3 - Power Tool Cleaning; 1982 (Ed. 2004).
- J. SSPC-SP 6 - Commercial Blast Cleaning; 2007.
- K. SSPC-SP 13 - Surface Preparation of Concrete; (Reaffirmed 2015); 2003.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples for Initial Selection: For each type of topcoat product indicated.
 - 1. Color schedules will be furnished to Contractor, by SJCF, before application of prime coats.
- D. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience.

1.06 MOCK-UP

- A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.
- B. Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
- C. Apply benchmark samples after permanent lighting and HVAC services have been activated.
- D. Locate where directed by Architect.
- E. Final approval of color selections will be based on benchmark samples.
 - 1. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by SJCF at no added cost to Owner.
- F. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible, for interior/exterior paints.
 - 1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by SJCF is obtained using the specified procedures for substitutions.
- B. Paint "Series" are intended to specify type and quality of a paint line which includes white and tint bases. Contractor shall use proper base for color(s) selected including accent colors.
- C. Paints:
 - 1. Base Manufacturer: Sherwin-Williams Company: www.sherwin-williams.com.
 - 2. Other acceptable manufacturers equal first line products may be submitted after bidding and shall be subject to SJCF approval:
 - 3. PPG Paints: www.ppgpaints.com/#sle.
 - 4. Glidden Professional: www.glidden.com.
 - 5. Tnemec Inc.: www.tnemec.com.
 - 6. Benjamin Moore & Co.: www.benjaminmoore.com.
 - 7. Coronado Paint: www.coronadopaint.com.
- D. Primer Sealers: Same manufacturer as top coats.
- E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 4. Supply each paint material in quantity required to complete entire project's work from a single production run.

5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Colors: To be selected from manufacturer's full range of available colors.
 1. Selection to be made by SJCF after award of contract.

2.03 PAINT SYSTEMS - EXTERIOR

- A. Ferrous Metal
 1. Preparation: Remove rust, clean with denatured alcohol or simple green. Mineral spirits are not to be used.
 2. Primer Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry).
 3. First Coat: S-W Pro Industrial Zero VOC Acrylic Gloss, B66-600 Series.
 4. Final Coat: S-W Pro Industrial Zero VOC Acrylic Gloss, B66-600 Series (6 mils wet, 2.5 mils dry per coat).
- B. Galvanized Metal and Aluminum
 1. Preparation: Clean with denatured alcohol or simple green. Mineral spirits are not to be used.
 2. First Coat: S-W A-100 Exterior Latex Gloss, A8W100 Series.
 3. Final Coat: S-W A-100 Exterior Latex Gloss, A8W100 Series (4 mils wet, 1.3 mils dry per coat).

2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Loose dirt, foreign matter, brushed or scraped off, leaving surface clean and dry before painting.
- C. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- E. If substrate preparation is the responsibility of another installer, notify SJCF of unsatisfactory preparation before proceeding.
- F. Test shop-applied primer for compatibility with subsequent cover materials.

- G. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Preparation of previously painted surfaces:
 - 1. Loose surface materials - scrape and brush well. Sand surface feathering edges.
 - 2. Oily films, clean with thinner and/or as specified for mildew.
 - 3. Dull high gloss surfaces.
 - 4. Remove wax with commercial stripping product.
 - 5. Rust and corrosion - sand or brush to clean metal.
 - 6. Apply primer to repaired or bare areas and finish as specified in paint systems. Apply only finish coat on solid painted surfaces.
 - 7. Paint entire surface from interior corner to interior corner where remodeling work causes patching or revision in the painted surfaces.
- E. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- F. Seal surfaces that might cause bleed through or staining of topcoat.
- G. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- H. Asphalt, Creosote, or Bituminous Surfaces: Remove foreign particles to permit adhesion of finishing materials. Apply latex based sealer or primer.
- I. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- J. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 - 2. Prepare surface according to SSPC-SP 2.
- K. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- L. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.
 - 1. Paint top and bottom of doors same as face and edges. Paint exterior doors same inside and out with exterior paint system.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Unless specified otherwise, apply paint with brush, spray, or roller as recommended by manufacturer to recommended thickness minimum. **Use a spray or roller application on hollow metal doors and frames for a brushless finish.**
- C. Apply products in accordance with manufacturer's written instructions.
- D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

- E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- F. Apply each coat to uniform appearance.
 - 1. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- G. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.
- H. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance at no cost to Owner.
- I. Sand metal surfaces lightly between coats to achieve required finish.
- J. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- K. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces

3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by SJCF, and leave in an undamaged condition.
- C. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 91 23 - INTERIOR PAINTING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints, stains, and varnishes.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
 - 1. General: Paint all exposed surfaces, except as otherwise indicated, whether or not colors are designated. If not designated, match adjacent painted surface; if not in a painted surface, in general match trim color.
 - 2. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 3. Exposed surfaces of steel lintels and ledge angles.
 - 4. Apply transparent finish and stain to all exposed finish carpentry and trim including wood panels on architectural wood casework.
 - 5. Prime surfaces to receive wall coverings and digitally printed wall coverings.
 - 6. Mechanical and Electrical:
 - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, electrical equipment, and grilles, registers, and louvers, which are not already factory pre-finished, unless otherwise indicated.
 - b. In finished areas, paint shop-primed items.
 - 7. Mechanical, electrical, utility and custodial spaces: Walls and ceilings or structure, as applicable, be finish painted where visible from normal level viewing. In this situation paint pipe, conduit fittings, accessories, etc., mounted at surfaces or within structure to be painted (more easily painted than masked out). Painting of ducts is required. Painting of piping, conduit, fittings, accessories, etc., positioned away from painted surfaces (not requiring masking to prevent being painted) is not required.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Unless otherwise indicated, shop priming of ferrous metal items and fabricated components are included under their respective trades.
 - 3. Items indicated to receive other finishes.
 - 4. Items indicated to remain unfinished.
 - 5. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 6. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
 - 7. Marble, granite, slate, and other natural stones.
 - 8. Floors, unless specifically indicated.
 - 9. Ceramic and other tiles.
 - 10. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
 - 11. Glass.
 - 12. Concrete masonry units in utility, mechanical, and electrical spaces.
 - 13. Acoustical materials, unless specifically indicated.
 - 14. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Shop-primed items.
- B. Section 09 91 13 - Exterior Painting.
- C. Section 09 96 00 - High-Performance Coatings.

1.03 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.
- C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, www.paintinfo.com.
- D. SSPC V1 (PM1) - Good Painting Practice: Painting Manual, Volume 1; Fourth Edition.
- E. SSPC V2 (PM2) - Systems and Specifications: Steel Structures Painting Manual, Volume 2; Fourth Edition.
- F. SSPC-SP 1 - Solvent Cleaning; 2015.
- G. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).
- H. SSPC-SP 3 - Power Tool Cleaning; 1982 (Ed. 2004).
- I. SSPC-SP 6 - Commercial Blast Cleaning; 2007.
- J. SSPC-SP 13 - Surface Preparation of Concrete; (Reaffirmed 2015); 2003.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples for Initial Selection: For each type of topcoat product indicated.
 - 1. Color schedules will be furnished to Contractor, by SJCF, before application of prime coats.
- D. Manufacturer's Instructions: Indicate special surface preparation procedures.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience.

1.06 MOCK-UP

- A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.
- B. Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
- C. Apply benchmark samples after permanent lighting and other environmental services have been activated.
- D. Locate where directed by Architect.

- E. Final approval of color selections will be based on benchmark samples.
 - 1. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by SJCF at no added cost to Owner.
- F. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F (10 degrees C) for interiors unless required otherwise by manufacturer's instructions.
- E. Minimum Application Temperature for Varnish Finishes: 65 degrees F (18 degrees C) for interior, unless required otherwise by manufacturer's instructions.
- F. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible, for interior/exterior paints.
 - 1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by SJCF is obtained using the specified procedures for substitutions.
- B. Paint "Series" are intended to specify type and quality of a paint line which includes white and tint bases. Contractor shall use proper base for color(s) selected including accent colors.
- C. Paints:
 - 1. Base Manufacturer: Sherwin-Williams Company: www.sherwin-williams.com.
 - 2. Other acceptable manufacturers equal first line products may be submitted after bidding and shall be subject to SJCF approval:
 - 3. PPG Paints: www.ppgpaints.com/#sle.
 - 4. Glidden Professional: www.glidden.com.
 - 5. Tnemec Inc.: www.tnemec.com.
 - 6. Benjamin Moore & Co.: www.benjaminmoore.com.
 - 7. Coronado Paint: www.coronadopaint.com.
- D. Transparent Finishes:
 - 1. Base Manufacturer: Sherwin-Williams Company: www.sherwin-williams.com.

- E. Stains:
 - 1. Base Manufacturer: Sherwin-Williams Company: www.sherwin-williams.com.
- F. Primer Sealers: Same manufacturer as top coats.
- G. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 4. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
 - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Colors: To be selected from manufacturer's full range of available colors.
 - 1. Selection to be made by SJCF after award of contract.

2.03 PAINT SYSTEMS - INTERIOR

- A. Ferrous Metal (Gloss)
 - 1. Preparation: Remove rust, clean with denatured alcohol or simple green. No mineral spirits are to be used.
 - 2. Primer Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66W310 Series (5 mils wet, 2 mils dry).
 - 3. First Coat: S-W Pro Industrial Zero VOC Acrylic Gloss, B66-600 Series
 - 4. Final Coat: S-W Pro Industrial Zero VOC Acrylic Gloss, B66-600 Series (6 mils wet, 2.5 mils dry per coat).
Touch up primer (material) is specified for use on metals specified Division 05 whether topcoat is required or not.
- B. Galvanized Metal and Aluminum (Gloss)
 - 1. Preparation: Wash with denatured alcohol or simple green. No mineral spirits are to be used.
 - 2. Primer Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66W310 Series (5-10 mils wet, 2-4 mils dry).
 - 3. First Coat: S-W ProMar 200 Latex Gloss Enamel, B21-2200 Series.
 - 4. Final Coat: S-W ProMar 200 Latex Gloss Enamel, B21-2200 Series (4 mils wet, 1.5 mils dry per coat).
- C. Masonry Block (Semi-Gloss)

1. Primer Coat: S-W PrepRite Block Filler, B25W25 (16 mils wet, 8 mils dry). No pin holes allowed.
 2. First Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series.
 3. Final Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 (4 mils wet, 1.7 mils dry per coat).
- D. Concrete - Tilt-up, Precast, and Poured-in-place Concrete. (Semi-Gloss)
1. Primer Coat: S-W Loxon Concrete and Masonry Primer, A24W8300 (8 mils wet, 3.2 mils dry).
 2. First Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series.
 3. Final Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series (4 mils wet, 1.7 mils dry per coat).
- E. Wood - Painted (Semi-Gloss)
1. Primer Coat: S-W Premium Wall and Wood Primer, B28W8111 Series (4 mils wet, 1.8 mils dry).
 2. First Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series.
 3. Final Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series (4 mils wet, 1.3 mils dry per coat).
- F. Wood - Stain with Clear Finish
1. 1st Coat: S-W Wood Classics 250 Oil Stain, A49-800 Series
 2. 2nd Coat: S-W Wood Classics Waterborne Polyurethane Varnish, Satin
 3. 3rd Coat: S-W Wood Classics Waterborne Polyurethane Varnish, Satin (4 mils wet, 1 mil dry per coat).
- G. Plaster or Drywall/Gypsum Board (Eg-Shel)
1. Preparation: Brush or wipe sand finish plaster surfaces to remove lightly bonded sand particles before painting.
 2. Primer Coat: S-W ProMar Zero VOC Latex Primer, B28W2600 (4 mils wet, 1 mils dry).
 3. First Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series.
 4. Final Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series (4 mils wet, 1.7 mils dry per coat).
- H. Brick Wall Sealer
1. First Coat: H & C Wet Look Sealer.
 2. Final Coat: H & C Wet Look Sealer.

2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Loose dirt, foreign matter, brushed or scraped off, leaving surface clean and dry before painting.
- C. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

- E. If substrate preparation is the responsibility of another installer, notify SJCF of unsatisfactory preparation before proceeding.
- F. Test shop-applied primer for compatibility with subsequent cover materials.
- G. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Plaster and Stucco: 12 percent.
 - 3. Masonry, Concrete, and Concrete Masonry Units : 12 percent.
 - 4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 - 5. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Clean dust, dirt, and debris from rooms before interior painting.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- D. Remove or repair existing paints or finishes that exhibit surface defects.
- E. Preparation of previously painted surfaces:
 - 1. Loose surface materials - scrape and brush well. Sand surface feathering edges.
 - 2. Oily films, clean with thinner and/or as specified for mildew.
 - 3. Dull high gloss surfaces.
 - 4. Remove wax with commercial stripping product.
 - 5. Rust and corrosion - sand or brush to clean metal.
 - 6. Apply primer to repaired or bare areas and finish as specified in paint systems. Apply only finish coat on solid painted surfaces.
 - 7. Paint entire surface from interior corner to interior corner where remodeling work causes patching or revision in the painted surfaces.
- F. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- G. Seal surfaces that might cause bleed through or staining of topcoat.
- H. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- I. Concrete:
 - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - 2. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.
 - 3. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- J. Masonry:
 - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 - 2. Prepare surface as recommended by top coat manufacturer.
 - 3. Do not paint surfaces if moisture content to be painted exceeds that permitted in manufacturer's written instructions.
- K. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

- L. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- M. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- N. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- O. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- P. Copper: Remove contamination by steam, high pressure water, or solvent washing.
- Q. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 - 2. Prepare surface according to SSPC-SP 2.
- R. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- S. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- T. Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.
- U. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.
 - 1. Paint top and bottom of doors same as face and edges. Paint exterior doors same inside and out with exterior paint system.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Unless specified otherwise, apply paint with brush, spray, or roller as recommended by manufacturer to recommended thickness minimum. **Use a spray or roller application on hollow metal doors and door/window frames for a brushless finish.**
- C. Apply products in accordance with manufacturer's written instructions.
- D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- F. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
 - 1. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- G. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- H. Sand wood and metal surfaces lightly between coats to achieve required finish.
- I. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

- J. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- K. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces

3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by SJCF, and leave in an undamaged condition.
- C. Touch-up damaged finishes after Substantial Completion.

3.06 COLOR SCHEDULE

- A. Accent Paint: Accent colors will be selected for exposed steel structure, hollow metal door frames.
- B. Soffits: Accent colors mayl be selected for exposed soffits.
- C. Walls: Accent colors will be selected for select walls in office areas.

END OF SECTION

SECTION 09 96 00 - HIGH-PERFORMANCE COATINGS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. High performance coatings.
- B. Surface preparation.

1.02 RELATED REQUIREMENTS

- A. Section 09 91 23 - Interior Painting.

1.03 REFERENCE STANDARDS

- A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, www.paintinfo.com.
- B. SSPC-SP 1 - Solvent Cleaning; 2015.
- C. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).
- D. SSPC-SP 3 - Power Tool Cleaning; 1982 (Ed. 2004).
- E. SSPC-SP 11 - Power Tool Cleaning to Bare Metal; 2012 (Ed. 2013).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide complete list of all products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. Cross-reference to specified coating system(s) product is to be used in; include description of each system.
- C. Samples for Initial Selection: For each type of topcoat product indicated.
 - 1. Color schedules will be furnished to Contractor, by SJCF, before application of prime coats.
- D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years experience.

1.06 MOCK-UP

- A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.
- B. Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
- C. Apply benchmark samples after permanent lighting and other environmental services have been activated.
- D. Locate where directed.
- E. Final approval of color selections will be based on benchmark samples.
 - 1. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by SJCF at no added cost to Owner.

- F. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not install materials when temperature is below 55 degrees F (13 degrees C) or above 90 degrees F (32 degrees C).
- B. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.
- C. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.
- D. Restrict traffic from area where coating is being applied or is curing.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide high performance coating products from the same manufacturer to the greatest extent possible.
- B. High-Performance Coatings:
 - 1. Sherwin-Williams Company: www.protective.sherwin-williams.com/industries.
 - 2. Tnemec Company, Inc: www.tnemec.com.
 - 3. Glidden Professional: www.gliddenprofessional.com.
 - 4. Benjamin Moore & Co.: www.benjaminmoore.com.
 - 5. Coronado Paint: www.coronadopaint.com.
 - 6. PPG Porter Paints: www.ppgporterpaints.com.
 - 7. Substitutions: Section 01 60 00 - Product Requirements.

2.02 TOP COAT AND PRIMER MATERIALS

- A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
- B. Provide all paint and coating products from the same manufacturer to the greatest extent possible.
- C. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.
- D. Epoxy Coating where scheduled:
 - 1. Top Coat(s): High Performance Institutional, Two-Component, Water Based Coating.
 - a. Number of coats: Two.
 - b. Product characteristics:
 - 1) Dry film thickness, per coat: 2.5-3 mils, minimum.
 - c. Sheen: semi-gloss.
 - d. Products:
 - 1) Sherwin-Williams Company; Waterbased Catalyzed Epoxy, B70W211/B60V25: www.sherwin-williams.com.

- 2) Substitutions: Section 01 60 00 - Product Requirements.
2. Primer(s): Provide the following unless other primer is required or recommended by coating manufacturer.
 - a. For Gypsum Board Walls
 - 1) Products:
 - (a) Sherwin-Williams Company; ProGreen 200 Interior Latex Primer, B28W600: www.sherwin-williams.com.
 - (b) Substitutions: Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Do not begin application of coatings until substrates have been properly prepared.
- C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.
- D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- E. If substrate preparation is the responsibility of another installer, notify SJCF of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces of loose foreign matter.
- B. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.
- C. Remove finish hardware, fixture covers, and accessories and store.
- D. Existing Painted and Sealed Surfaces:
 1. Remove loose, flaking, and peeling paint. Feather edge and sand smooth edges of chipped paint.
 2. Clean with mixture of trisodium phosphate and water to remove surface grease and foreign matter.
- E. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.03 PRIMING

- A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

3.04 COATING APPLICATION

- A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified.
- B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. Clean surfaces immediately of overspray, splatter, and excess material.

- C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

- A. Protect finished work from damage.
- B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by SJCF, and leave in an undamaged condition.
- C. Touch-up damaged coatings after Substantial Completion.

END OF SECTION

SECTION 10 11 01 - VISUAL DISPLAY BOARDS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Markerboards.
- B. Visual Display Rails.

1.02 REFERENCE STANDARDS

- A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.
- B. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2009a.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data on chalkboard, markerboard, tackboard, tackboard surface covering, trim, and accessories.
- C. Shop Drawings: Indicate wall elevations, dimensions, joint locations, locations of special-purpose graphics, special anchor details.
- D. Samples: Submit color charts for selection of color and texture of markerboard and trim.
- E. Maintenance Data: Include data on regular cleaning, stain removal .

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.05 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide Life of the Building warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Visual Display Boards:
 - 1. Claridge Products and Equipment, Inc: www.claridgeproducts.com.
 - 2. Polyvision Corporation (Nelson Adams): www.polyvision.com.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 VISUAL DISPLAY BOARDS

- A. Markerboards: Porcelain enamel on steel, laminated to core.
 - 1. Color: As selected from manufacturer's full range.
 - 2. Steel Face Sheet Thickness: 24 gage, 0.0239 inch (0.61 mm).
 - 3. Core: Medium Density Fiberboard (MDF), 1/2 inch (13 mm) thick, laminated to face sheet.
 - 4. Backing: Aluminum foil, laminated to core.
 - 5. Height: 48 inches (1220 mm).
 - 6. Length: As indicated on drawings.
 - 7. Frame: Extruded aluminum, with concealed fasteners.
 - 8. Frame Finish: Powder-Coat, selected from manufacturer's standard colors.

9. Accessories: Provide chalk tray and map rail.
 10. Basis of Design: Use the following or any equivalent made by one of the listed manufacturers: Factory-built units equal to Claridge Series 5, LCS-II Markerboard.
- B. Visual Display Rails
1. Width: 1 inch (25.4 mm).
 2. Insert: Vinyl coated fabric, selected from Manufacturer's standard finishes.
 3. Basis of Design: Use the following or any equivalent made by one of the listed manufacturers: Claridge Map and Display Rail.

2.03 MATERIALS

- A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.
- B. Foil Backing: Aluminum foil sheet, 0.005 inch (0.13 mm) thick.
- C. Adhesives: Type used by manufacturer.

2.04 ACCESSORIES

- A. Map Rail: Extruded aluminum, manufacturer's standard profile, with cork insert and runners for accessories; 1 inch (25 mm) wide overall, full width of frame.
- B. Map Supports: Formed aluminum sliding hooks and roller brackets to fit map rail.
 1. Provide 2 map hooks and 2 roller brackets for each run of map rail.
- C. Temporary Protective Cover: Sheet polyethylene, 8 mil (0.2 mm) thick.
- D. Chalk Tray: Aluminum, manufacturer's standard profile one piece full length of chalkboard, molded ends; concealed fasteners, same finish as frame.
- E. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.02 INSTALLATION

- A. Install boards in accordance with manufacturer's instructions.
 1. Field install on concealed continuous top support of adequate strength and fastening to support board without deflection. Also use mastic in spots approximately 16 inches (406 mm) o.c. each way.
- B. Before installing the chalkboards, markerboards, tackboards or visual display rails always verify with SJCF the height and location of the units regardless of what is on the drawings.
- C. Secure units level and plumb.
- D. Butt Joints: Install with tight hairline joints.

3.03 CLEANING

- A. Clean board surfaces in accordance with manufacturer's instructions.
- B. Cover with protective cover, taped to frame.
- C. Remove temporary protective cover at date of Substantial Completion.

END OF SECTION

SECTION 10 21 13.19 - PLASTIC TOILET COMPARTMENTS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Privacy screens for video visitation units.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.
- B. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- C. Product Data: Provide data on panel construction, hardware, and accessories.
- D. Manufacturer's Installation Instructions: Indicate special procedures.

1.04 WARRANTY

- A. Manufacturer shall provide a fifteen year warranty against corrosion, breakage and delamination of plastic material under normal conditions.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Solid Plastic Toilet Compartments:
 - 1. Ampco Products, Inc: www.ampco.com.
 - 2. Metpar Corp: www.metpar.com.
 - 3. Scranton Products (Santana/Comtec/Capital): www.scrantonproducts.com.
 - 4. General Partitions Mfg. Corp: www.generalpartitions.com.
 - 5. Global Steel Products Corp.: www.globalpartitions.com.
 - 6. Accurate Partitions Corporation: www.accuratepartitions.com.
 - 7. Hadrian Manufacturing Inc.: www.hadrian-inc.com.
 - 8. The Mills Company, subsidiary of Bradley Corp.: www.bradleycorp.com.
 - 9. Substitutions: Section 01 60 00 - Product Requirements.

2.02 SOLID PLASTIC TOILET DIVIDERS

- A. Privacy Screens: Factory fabricated divider panels made of solid molded high density polyethylene (HDPE), wall-hung.
 - 1. Color: Single color as selected from manufacturer's standard colors.
 - 2. Seamless, with eased edges and with homogenous color and pattern throughout thickness of material.
 - 3. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum or stainless-steel strip fastened to exposed bottom edges of solid-polymer components to prevent burning, if required by manufacturer.
- B. Panels:
 - 1. Thickness: 1 inch (25 mm).
- C. Privacy Screen: Wall mounted with full height continuous bracket.

2.03 ACCESSORIES

- A. Wall Brackets: Continuous type, natural anodized aluminum.
 - 1. Full-Height, of manufacturer's standard design for attaching panels and screens to walls and pilasters, brackets to be factory prepared for field installed anchors, heavy duty.
- B. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
 - 1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.

2.04 FABRICATION

- A. General:
 - 1. Provide standard doors, panels, screens and pilasters fabricated for compartment system. Toilet compartment manufacturer and/or installer shall include all cutouts as required to receive compartment-mounted accessories in the cost of their Work.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that field measurements are as indicated.
- C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain not more than 1 inch (25 mm) space between wall and panels.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch (6 mm).
- B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.04 SCHEDULES

- A. Room113: (13) privacy screens 24"x42" with continuous bracket.

END OF SECTION

SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

1.02 REFERENCE STANDARDS

- A. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, and wall bracket mounted measurements.
 - 1. Provide schedule of types of extinguishers and locations.
- C. Product Data: Provide color and finish, anchorage details, and lettering if any.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.04 QUALITY ASSURANCE

- A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

1.05 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

1.06 COORDINATION

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate size of fire protection cabinets to ensure that type and capacity of fire hoses, hose valves, and hose racks indicated are accommodated.
- C. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Fire Extinguisher Cabinets and Accessories:
 - 1. JL Industries, Inc: www.jlindustries.com.
 - 2. Larsen's Manufacturing Co: www.larsensmfg.com.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 - 1. Provide extinguishers labeled by UL for the purpose specified and indicated.
- B. Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage.
 - 1. Size and classification as scheduled.

2. Finish: Baked polyester powder coat, color as selected.

2.03 FIRE EXTINGUISHER CABINETS

- A. Metal: Formed primed steel sheet; 0.036 inch (0.9 mm) thick base metal.
- B. Cabinet Configuration: Semi-recessed type.
 1. Sized to accommodate accessories.
 2. Exterior nominal dimensions of 12 inch (304.8 mm) wide by 21 inch (533.4 mm) high by 5 1/2 inch (139.7 mm) deep.
 3. Rolled Edge Trim: 2 1/2 inch (63.5 mm).
 4. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428 inch (1.1 mm) thick, cold-rolled steel sheet lined with minimum 5/8 inch (16 mm) thick, fire-barrier material. Provide factory-drilled mounting holes.
- C. Door: 0.036 inch (0.9 mm) thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with continuous piano hinge. Provide roller type catch.
- D. Door Style: Fully glazed panel with frame where scheduled. Solid opaque panel with frame where scheduled.
- E. Door Glazing: Glass, clear, 1/8 inch (3 mm) thick tempered. Set in resilient channel gasket glazing.
- F. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.
- G. Weld, fill, and grind components smooth.
- H. Finish of Cabinet Exterior Trim and Door: Baked enamel, white color.
- I. Finish of Cabinet Interior: White enamel.

2.04 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, galvanized and enamel finished.
 1. Designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with black or red baked-enamel finish.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as scheduled.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.
- C. Examine fire extinguishers for proper charging and tagging.
 1. Remove and replace damaged, defective, or undercharged fire extinguishers.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, 24 inches (609.6 mm) from finished floor to inside bottom of cabinet.
- C. Secure rigidly in place.
- D. Place extinguishers and accessories in cabinets.
- E. Seal through penetrations with firestopping sealant.

3.03 CLEANING AND PROTECTION

- A. Adjust fire protection cabinet doors to operate easily without binding.

- B. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- C. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
- D. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.04 SCHEDULES

- A. Fire Extinguishers:
 - 1. Corridors, hallways, and rooms: Multipurpose Dry-Chemical Type in Steel Container: UL-rated 3-A:40-B:C, 5 lb (2.3 kg) nominal capacity, with monoammonium phosphate-based dry chemical. Equal to J.L. Industries, Inc. Product Cosmic 5E: www.jlindustries.com.
- B. Cabinets and Mounting Brackets:
 - 1. Corridors, hallways, and rooms: Provide semi-recessed cabinet with rolled edge and a full glazed panel in the door.
 - 2. Fire Rated Walls at Cabinets: At 1 and 2 hour fire rated stud walls with gypsum wall board, provide a fire rated cabinet. For 3 hour or greater fire rated stud walls, provide standard cabinet, Contractor shall line opening with fire rated material.

END OF SECTION

SECTION 10 51 00 - LOCKERS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Heavy-duty metal lockers.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.
- C. Shop Drawings: Indicate locker plan layout, plan, elevations, details and attachments to other work.
 - 1. Show locker trim and accessories.
 - 2. Include locker identification system and numbering sequence.
- D. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain metal lockers and accessories from single source from single manufacturer in as much as possible.
- C. Regulatory Requirements: Where metal lockers are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect locker finish and adjacent surfaces from damage.
- B. Deliver master and control keys, combination control charts/CD to Owner by registered mail or overnight package service. Coordinate address of Representative of Owner with SJCF.

1.05 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.06 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.07 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
 - 1. Warranty Period for Knocked-Down Metal Lockers: Two years from date of Substantial Completion.
 - 2. Warranty Period for All-Welded Metal Lockers: 10 years from date of Substantial Completion.

PART 2 PRODUCTS**2.01 HEAVY DUTY METAL LOCKERS**

- A. Manufacturers
 - 1. Lockers:
 - a. American Locker, Ambassador Series: www.americanlocker.com
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Material: Stainless steel ASTM A167 Type 304.
- C. Frame: Min. 16 Ga., 302/304 polished
- D. Doors: Min. 16 Ga. Textured stainless steel finish
- E. Tops, Bottoms, Backs and Shelves: Min. 20 Ga., 302/304 polished.
- F. Sides: Min. 24 Ga. 302/304 polished.
- G. Locker Base, Door, Handle and Lock Assembly: Stainless Steel
- H. Locks: Coin/Token return. Key and cylinder removable for replacement. Coin slot concealed when door is shut. Anti-key-turn-back feature.

2.02 ACCESSORIES

- A. Manufactured stainless steel 4" high base.
- B. Filler Panels / Trim: Fabricated from manufacturer's standard thickness, but not less than 20 gauge 0.036 inch (0.91 mm) nominal-thickness steel sheet, for recessed installation.
- C. Lockers For Physically Challenged: Where indicated on the drawings or quantity as required to meet U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1., provide locker with handle and latch that meets requirements. Provide international symbol for physically challenged access decal on face of locker door.
 - 1. Locate bottom shelf no lower than 15 inch (381 mm) above the floor.
 - 2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inch (1219 mm) above the floor.

2.03 FABRICATION

- A. Fabricate metal lockers square, rigid, and without warp and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
- B. All-Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Uni-body construction.
- C. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates.
- D. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that prepared recess is proper size.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install lockers plumb and square.
- C. Place and secure on prepared base.
- D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 lb (445 N).
 - 1. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
- E. All-Welded Metal Lockers: Connect groups together with standard fasteners, with no exposed fasteners on face frames.
- F. Install filler panels.
 - 1. Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
- G. Install accessories.
- H. Replace components that do not operate smoothly.

3.03 CLEANING

- A. Clean locker interiors and exterior surfaces.
- B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

3.04 SCHEDULES

- A. Public Lockers:
 - 1. Corridors: [4] units ([W3] 36"w frames) - Each locker 12 inches (305 mm) wide x [18] inches ([457] mm) deep x [12] inches ([305] mm) high. Six Tier, Flat top, [SS] base by [manufacturer]. Coin / Token return as specified.

END OF SECTION

SECTION 11 53 00 - LABORATORY EQUIPMENT**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Laboratory equipment.
- B. Connection to utilities.
 - 1. Mechanical and Electrical Contractor shall provide all necessary connections for final, completed installation. Electrical devices within fume hood are shipped intact.
- C. Service fittings and outlets.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Large Components: Ensure that large components can be moved into final position without damage to other construction.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide equipment dimensions and construction, equipment capacities, physical dimensions, utility and service requirements and locations, point loads and accessories.
- C. Shop Drawings: Indicate equipment locations, large scale plans, elevations, cross sections, rough-in and anchor placement dimensions and tolerances, clearances required.
 - 1. Indicate locations and types of service fittings together with associated service supply connection required.
 - 2. Indicate duct connections, electrical connections, and locations of access panels.
 - 3. Include roughing-in information for mechanical, plumbing, and electrical connections.
 - 4. Show adjacent walls, doors, windows, other building components, laboratory casework, and other laboratory equipment. Indicate clearances from above items.
 - 5. Include layout of fume hoods in relation to lighting fixtures and air-conditioning registers and grilles.
- D. Manufacturer's Installation Instructions: Indicate special installation requirements.
- E. Operation Data: Include description of equipment operation and required adjusting and testing .
- F. Maintenance Data: Identify system maintenance requirements, servicing cycles, lubrication types required and spare part sources.
- G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the types of products specified in this section, with minimum three years of documented experience.
- B. Source Limitations: Obtain all fume hoods and equipment from single manufacturer.

1.05 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install fume hoods until building is enclosed, wet work and utility roughing-in are complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.06 COORDINATION

- A. Coordinate layout and installation of framing and reinforcements for lateral support of fume hoods.
- B. Coordinate installation of fume hoods with casework, fume hood exhaust ducts, and plumbing and electrical work.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Laboratory Equipment:
 - 1. Labconco Corporation: www.labconco.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COMPONENTS

- A. Equipment: Scheduled at end of this section.
- B. Installation Accessories: Provide all rough-in frames, anchors, supports, accessories and closure trim required for complete installation.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that utility connections, rough-in frames, anchors and supports are accurately placed and deliver building services at specified characteristics and/or within acceptable functional ranges.
- B. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- C. Verify that rough-in frames, anchors and supports are accurately placed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Anchor equipment securely in place.
- C. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.
- D. Touch-up minor damaged surfaces caused during installation. Replace damaged components as directed by SJCF.

3.03 ADJUSTING

- A. Adjust operating equipment to efficient operation.

3.04 FIELD QUALITY CONTROL

- A. Field test installed fume hoods according to "Flow Visualization and Velocity Procedure" requirements in ASHRAE 110.
 - 1. Conduct tests after building's HVAC system has been balanced and reviewed for conformance by the engineer.
 - 2. Adjust fume hoods, hood exhaust fans, and building's HVAC system and make other corrections until tested hoods perform as specified.
 - 3. After making corrections, retest fume hoods that failed to perform as specified.

4. Provide copies of test results to SJCF and include in Operation and Maintenance manuals.

3.05 CLOSEOUT ACTIVITIES

- A. Fume hood manufacturer shall demonstrate equipment operation and use.
- B. Schedule training session with representative of Owner to insure all persons involved with operation of equipment are included in the training session. Provide copy of attendance sheet from training session.

3.06 ADJUSTING AND CLEANING

- A. Adjust moving parts for smooth, near silent, accurate sash operation with one hand. Adjust sashes for uniform contact of rubber bumpers. Verify that counterbalances operate without interference.
- B. Clean finished surfaces, including both sides of glass; touch up as required; and remove or refinish damaged or soiled areas to match original factory finish, as approved by SJCF.

3.07 SCHEDULES

- A. Laboratory Hood:
 1. Labconco Corporation - Basic 70 Laboratory Hood, model 2246700 six foot wide, two foot depth interior, Spillstopper six foot wide epoxy worksurface, guardian air flow monitor, switch / monitor interconnect kit, and (2) 9902100 36" protector solvent base cabinets.
 2. Pegboard Drying Rack
 - a. 24"x30"
 - b. Epoxy resin back with SS drip tray with wall attachment
 - c. White pegs, half 6.5" / half 8"
 - d. manufacturer: Blackland Manufacturing: www.blacklandmfg.com
 - e. Substitutions: See Section 01 60 00 - Product Requirements.

END OF SECTION

SECTION 12 21 13 - HORIZONTAL LOUVER BLINDS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Horizontal slat louver blinds.
- B. Operating hardware.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.03 REFERENCE STANDARDS

- A. WCMA A100.1 - Safety of Corded Window Covering Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the placement of concealed blocking to support blinds. See Section 06 10 00.
- B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify SJCF of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating physical and dimensional characteristics.
- C. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.
- D. Samples for Initial Selection: For each type and color of horizontal louver blind.
 - 1. Include similar Samples of accessories involving color selection.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.07 FIELD CONDITIONS

- A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Horizontal Louver Blinds Without Side Guides:
 - 1. Hunter Douglas: www.hunterdouglas.com.
 - 2. Levolor Contract; Monaco 1 inch aluminum blind: www.levolorcontract.com.
 - 3. SWFcontract, a division of Spring Window Fashions, LLC.: www.swfcontract.com.
 - 4. SWF Contract; Bali Classics: www.swfcontract.com.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 BLINDS WITHOUT SIDE GUIDES

- A. Description: Horizontal slat louvers hung from full-width headrail with full-width bottom rail.
- B. Manual Operation: Control of raising and lowering by cord with full range locking; blade angle adjustable by control wand.
- C. Metal Slats: Spring tempered pre-finished aluminum; radiused slat corners, with manufacturing burrs removed.
 - 1. Width: 1 inch (25.4 mm).
 - 2. Color: As selected by Architect.
- D. Slat Support: Woven polypropylene cord, ladder configuration.
 - 1. Shall be long enough for blind to hang within 1/4 inch (6.25 mm) of sill.
 - 2. Ladders: Evenly spaced across headrail at spacing that prevents long-term slat sag.
- E. Head Rail: Pre-finished, formed aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.
 - 1. Color: Same as slats.
- F. Bottom Rail: Pre-finished, formed PVC with top side shaped to match slat curvature; with end caps.
 - 1. Color: Same as headrail.
- G. Lift Cord: Braided nylon; continuous loop; complying with WCMA A100.1.
 - 1. Color: As selected by Architect.
- H. Control Wand: Extruded hollow plastic; hexagonal shape.
 - 1. Color: As selected by Architect.
- I. Headrail Attachment: Wall brackets where windows are flush or nearly flush with wall.
 - 1. Provide ceiling brackets where windows are recessed into a wall.
 - 2. Intermediate Support: Provide intermediate support brackets to produce support spacing recommended by blind manufacturer for weight and size of blind.
- J. Accessory Hardware: Type recommended by blind manufacturer.
- K. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard.

2.03 FABRICATION

- A. Determine sizes by field measurement.
- B. Fabricate blinds to cover window frames completely.
- C. At openings requiring multiple blind units, provide separate blind assemblies with space of 1/2 inch (12.7 mm) between blinds, located at window mullion centers.
- D. Mounting and Intermediate Brackets: Designed for removal and reinstallation of blind without damaging blind and adjacent surfaces, for supporting blind components, and for bracket positions and blind placement indicated.
- E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that openings are ready to receive the work.
- B. Ensure structural blocking and supports are correctly placed. See Section 06 10 00.

3.02 INSTALLATION

- A. Install blinds in accordance with manufacturer's instructions.
- B. Secure in place with flush countersunk fasteners.
- C. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units
- D. Locate so exterior slat edges are not closer than 2 inch (51 mm) from interior faces of glass and not closer than 1/2 inch (13 mm) from interior faces of glazing frames through full operating ranges of blinds.
- E. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

3.03 TOLERANCES

- A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch (6 mm).
- B. Maximum Offset From Level: 1/8 inch (3 mm).

3.04 ADJUSTING

- A. Adjust blinds for smooth operation.
- B. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.

3.05 CLEANING

- A. Clean blind surfaces just prior to occupancy.
- B. Replace damaged horizontal louver blinds that cannot be repaired in a manner approved by SJCF before time of Substantial Completion.

END OF SECTION

SECTION 12 36 00 - COUNTERTOPS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Countertops for architectural cabinet work.

1.02 RELATED REQUIREMENTS

- A. Section 06 41 00 - Architectural Wood Casework.
- B. Section 11 53 00 - Laboratory Equipment: Work surfaces inside fume hoods.

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 2009.
- B. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- D. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2010).
- E. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2014.
- F. ASTM D785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials; 2008.
- G. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2010.
- H. ASTM D792 - Density and Specific Gravity (Relative Density) of Plastics by Displacement; 2013.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- J. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.
- K. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- L. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- M. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material; 2013.
- N. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.
 - 1. Show locations for plumbing fixtures, cut outs and other items installed in countertops.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

- E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- F. Installation Instructions: Manufacturer's installation instructions and recommendations.
- G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.
- H. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates, including the QCP project registration number for casework with plastic laminate countertops.

1.05 QUALITY ASSURANCE

- A. Plastic Laminate Countertops: Quality Assurance as indicated in 06 41 00 - Architectural Wood Casework.
- B. Epoxy Resin Installer Qualifications: Company specializing in installation of the products specified in this section with minimum three years of documented experience.
- C. Solid Surfacing Installer Qualifications: Company specializing in installation of the products specified in this section with minimum three years of documented experience and is certified by the manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
- C. Protect plastic laminate tops from moisture damage.
- D. Do not deliver countertops until painting, wet work, grinding, and similar operations have been completed in installation areas.

1.07 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
 - 1. Building shall be enclosed, wet work shall be complete, and HVAC system shall be operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where countertop is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing countertop; show recorded measurements on shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.
 - 1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with manufacture of countertop without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

PART 2 PRODUCTS

2.01 COUNTERTOPS

- A. Quality Standard: See Section 06 41 00.
- B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
 - 1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch (1.2 mm) nominal thickness.
 - a. Manufacturers; Provide laminate from one or a combination of the following:

- 1) Formica Corporation: www.formica.com.
 - 2) Panolam Industries International, Inc Nevamar: www.nevamar.com.
 - 3) Wilsonart: www.wilsonart.com.
 - 4) Substitutions: See Section 01 60 00 - Product Requirements.
 - b. Finish: matte.
 - c. Surface Color and Pattern: selected from manufacturer's full range of standard colors in matte finish.
 2. Exposed Edge Treatment: Extruded PVC, flat shaped; smooth finish; of width to match component thickness, color as selected from manufacturer's standards, where indicated.
 - a. Thickness: 0.12 inch (3 mm).
 3. Back and End Splashes: Same material, same construction.
 - a. Provide end splashes at each end of a countertop; including countertops against a wall or other casework. Separate for field attachment.
 4. Fabricate in accordance with AWI/AWMAC/WI (AWS), Section 11 - Countertops, Custom Grade.
 5. Laminate Backer: BKL, 0.020 inch (0.51 mm) nominal thickness or thickness required by AWI/AWMAC/WI (AWS) standards, undecorated; for application to concealed backside of countertop faced with high pressure decorative laminate.
- C. Epoxy Resin Countertops: Filled epoxy resin molded into homogenous, non-porous sheets; no surface coating and color and pattern consistent throughout thickness; with integral or adhesively seamed components.
1. Manufacturers:
 - a. Durcon, Inc: www.durcon.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Flat Surface Thickness: 1 inch (25 mm), nominal.
 3. Chemical Resistance: Uncoated material shall withstand spot test with the following reagents in standard laboratory concentrations for 24 hours.
 - a. No Effect: Hydrochloric acid 37%, sulfuric acid 25%, acetic acid 98%, ammonium hydroxide 28%, chromic acid 60%, ethyl ether, ethyl alcohol, nitric acid 70%, sodium hydroxide 10%, carbon tetrachloride, gasoline.
 - b. Slight Effect: Ethyl acetate, acetone, benzene, chloroform, dioxane, formic acid 90%, mono chlorobenzene, sodium hydroxide 20%, trichlorethylene.
 4. Flammability: Self-extinguishing, when tested in accordance with ASTM D635.
 5. Water Absorption: Maximum of 0.008% by weight, when tested in accordance with ASTM D570.
 6. Density/specific gravity: Minimum test rating of 134.8 PSF or 2.16 gcm, when tested in accordance to ASTM D792.
 7. Rockwell Hardness "M": Minimum of 110, when tested in accordance with ASTM D785.
 8. Flexural Strength: Minimum of 14.9 kpsi (103 MPa), when tested in accordance with ASTM D790.
 9. Surface burning characteristics: Flame spread index 7.4 and smoke develop index of 221.2, when tested in accordance to ASTM E84.
 10. Surface burning characteristics in vertical position: Maximum flame spread index of 7.4 and smoke developed index of 221.2, when tested in accordance to ASTM D3801.
 11. Surface Finish: Smooth, non-glare.
 12. Color: Black.
 13. Exposed Edge Shape: 1/4 inch (2 mm) radius corner.
 14. Drip Edge: Drip groove 1/8 inch (3 mm) wide and deep, located 1/2 inch (12 mm) back from edge on underside of all exposed edges.

15. Back and End Splashes: Same material, same thickness; provide splashes at all walls and adjacent millwork, separate for field attachment.
16. Sinks and Service Fittings: To be installed by Mechanical Contractor.
- D. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
 1. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.
 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Manufacturers:
 - 1) Avonite Surfaces: www.avonitesurfaces.com.
 - 2) Dupont: www.corian.com.
 - 3) Formica Corporation: www.formica.com.
 - 4) Wilsonart: www.wilsonart.com.
 - 5) Substitutions: See Section 01 60 00 - Product Requirements.
 - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 - c. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
 - d. Color and Pattern: Color to be selected by SJCF from Corian price group D or equal.
 3. Other Components Thickness: 1/2 inch (12 mm), minimum.
 4. Exposed Edge Treatment: Built up to minimum 1 1/4 inch (32 mm) thick; square edge.
 5. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.
 - a. Provide splashes at all walls and adjacent millwork, separate for field attachment
- E. Stainless Steel Countertops: ASTM A666, Type 304, stainless steel sheet; 16 gage, 0.0625 inch (1.59 mm) nominal sheet thickness.
 1. Finish: 4B satin brushed finish.
 2. Edge Details: As indicated on drawings.

2.02 MATERIALS

- A. Wood-Based Components:
 1. Wood fabricated from old growth timber is not permitted.
- B. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf (20 kg/cu m) minimum density; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.
 1. At Sinks: Industrial-grade particleboard for the entire length of the countertop.
- C. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.
 1. At Sinks: Fiberboard with a 24-hour thickness swell factor of 5% or less, and a 24-hour water-absorption factor of 10% or less for the entire length of the countertop.
- D. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- E. Joint Sealant: Mildew-resistant silicone sealant, in colors matching components and as selected.
- F. Solid Surfacing Countertops:
 1. Conductive Tape: Manufacturer's standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.

2. Insulating Felt Tape: Manufacturer's standard for use with conductive tape in insulating solid surface material from adjacent heat source.

2.03 FABRICATION

- A. Fabricate laminate or wood countertops in accordance with standards governing fabrication quality that are specified in 06 41 00 - Architectural Wood Casework .
- B. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 1. Join lengths of tops using best method recommended by manufacturer.
 2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
 - a. Manufacturer of countertop shall provide all cutouts, including mechanical and electrical service fittings and sinks.
- C. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 2. Height: 4 inches (102 mm), unless otherwise indicated.
- D. Epoxy Resin: Provide in longest practical lengths.
 1. No joints permitted within octagonal or triangular shaped countertops.
- E. Solid Surfacing: Fabricate tops up to 144 inches (3657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
- F. Stainless Steel: Fabricate tops up to 144 inches (3657 mm) long in one piece including nosings and back and end splashes; accurately fitted mechanical field joints in lengths over that dimension are permitted.
 1. Weld joints; grind smooth and polish to match.
 2. Provide stainless steel hat channel stiffeners, welded or soldered to underside, where indicated on drawings.
 3. Provide wall clips for support of back/end splash turndowns.
 4. Sound Deadening: Apply water resistant, fire resistant sound deadening mastic to entire bottom surface.
- G. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify SJCF of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
 - 1. Locate field joints as shown on accepted shop drawings, factory-prepared so there is no jobsite processing of top and edge surfaces.
- B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch (16 mm).
- C. Attach stainless steel countertops using stainless steel fasteners and clips.
- D. Attach epoxy resin countertops using compatible adhesive.
 - 1. Adhesive as recommended by manufacturer of chemical top, applied at each corner and along perimeter edges of not more than 48 inch (1219 mm) on center.
- E. Align solid surface countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
 - 1. Carefully dress joints smooth, remove surface scratches and clean entire surface.
- F. Solid surface window sills: Install window stools full length of window, set securely into place using only concealed fasteners and manufacturer's approved adhesive.
 - 1. Provide minimum 1/8 inch (3.2 mm) expansion gaps on both sides of window sills, sealed with manufacturer's approved sealant.
 - 2. Window stools shall be plumb, true and level.
 - 3. Ease edges and sand smooth.
 - 4. Overhang wall a maximum 1/2 inch (12 mm). Ease corners.
- G. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.
- B. Offset From Wall, Countertops: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.
- C. Field Joints: Joints butted tight.

3.05 CLEANING

- A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

21 13 00 FIRE-SUPPRESSION SPRINKLERS

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes fire-suppression sprinklers, piping, and equipment for the following building systems:

- A. Wet-pipe, fire-suppression sprinklers, including piping, valves, specialties, and automatic sprinklers.
- B. Dry-pipe, fire-suppression sprinklers, including piping, valves, specialties, automatic sprinklers, air compressor, and accessories.

Related Sections include the following:

- A. Division 26 Section "Fire Alarm Systems" for alarm devices not in this Section.

DEFINITIONS:

Working Plans: Documents, including drawings, calculations, and material specifications prepared according to NFPA 13 for obtaining approval from authorities having jurisdiction.

SYSTEM PERFORMANCE REQUIREMENTS:

Design sprinklers and obtain approval from authorities having jurisdiction.

Design sprinkler piping according to the following and obtain approval from authorities having jurisdiction:

- A. Include 10 percent margin of safety for available water flow and pressure.
- B. Include losses through water-service piping, valves, and backflow preventers.
- C. Sprinkler Occupancy Hazard Classifications: As follows:
 - 1. Building Service Areas: Ordinary Hazard, Group 1.
 - 2. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
 - 3. General Storage Areas: Ordinary Hazard, Group 1.
 - 4. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - 5. Office and Public Areas: Light Hazard.
- D. Minimum Density for Automatic-Sprinkler Piping Design: As follows:
 - 1. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. (6.3 mL/s over 139-sq. m) area.
 - 2. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. (12.6 mL/s over 139-sq. m) area.
 - 3. Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq. ft. (18.9 mL/s over 232-sq. m) area.
 - 4. Special Occupancy Hazard: As determined by authorities having jurisdiction.
- E. Maximum Protection Area per Sprinkler: As follows:
 - 1. Office Space: 225 sq. ft. (20.9 sq. m).

2. Storage Areas: 130 sq. ft. (12.1 sq. m).
3. Mechanical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
4. Electrical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
5. Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.

Components and Installation: Capable of producing piping systems with 175-psig (1200-kPa) minimum working-pressure rating, unless otherwise indicated.

SUBMITTALS:

Product Data: For the following:

- A. Pipe and fitting materials and methods of joining for sprinkler piping.
- B. Pipe hangers and supports.
- C. Valves, including specialty valves, accessories, and devices.
- D. Alarm devices. Include electrical data.
- E. Air compressors. Include electrical data.
- F. Fire department connections. Include type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
- G. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.

Fire-Hydrant Flow Test Report: As specified in "Preparation" Article.

Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction. Include hydraulic calculations, if applicable.

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."

Maintenance Data: For each type of sprinkler specialty to include in maintenance manuals specified in Division 1.

QUALITY ASSURANCE:

Installer Qualifications: An experienced installer who has designed and installed fire-suppression piping similar to that indicated for this Project and obtained design approval and inspection approval from authorities having jurisdiction.

Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer. Base calculations on results of fire-hydrant flow test.

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 fire-suppression piping that are similar to those indicated for this Project in material, design, and extent.

Manufacturer Qualifications: Firms whose equipment, specialties, and accessories are listed by product name and manufacturer in UL's "Fire Protection Equipment Directory" and FM's "Fire Protection Approval Guide" and that comply with other requirements indicated.

Sprinkler Components: Listing/approval stamp, label, or other marking by a testing agency acceptable to authorities having jurisdiction.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

NFPA Standards: Equipment, specialties, accessories, installation, and testing complying with the following:

- A. NFPA 13, "Installation of Sprinkler Systems."
- B. NFPA 231, "General Storage."

EXTRA MATERIALS:

Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Sprinkler Cabinets: Finished, wall-mounting steel cabinet and hinged cover, with space for a minimum of six spare sprinklers plus sprinkler wrench. Include the number of sprinklers required by NFPA 13 and wrench for sprinklers. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

PART 2 PRODUCTS

MANUFACTURERS:

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:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Specialty Valves and Devices:
 - 1. Badger Fire Protection, Inc.
 - 2. Central Sprinkler Corp.
 - 3. Firematic Sprinkler Devices, Inc.
 - 4. Globe Fire Sprinkler Corp.
 - 5. Grinnell Corp.
 - 6. Reliable Automatic Sprinkler Co., Inc.
 - 7. Star Sprinkler Corp.
 - 8. Viking Corp.
- B. Water-Flow Indicators and Supervisory Switches:
 - 1. Gamewell Co.
 - 2. Grinnell Corp.
 - 3. Pittway Corp.; System Sensor Div.
 - 4. Potter Electric Signal Co.
 - 5. Reliable Automatic Sprinkler Co., Inc.
 - 6. Viking Corp.
 - 7. Watts Industries, Inc.; Water Products Div.
- C. Sprinkler, Drain and Alarm Test Fittings:
 - 1. Central Sprinkler Corp.
 - 2. Fire-End and Croker Corp.
 - 3. Grinnell Corp.
 - 4. Victaulic Co. of America.
- D. Sprinkler, Branch-Line Test Fittings:
 - 1. Elkhart Brass Mfg. Co., Inc.

2. Fire-End and Croker Corp.
 3. Smith Industries, Inc.; Potter-Roemer Div.
- E. Sprinkler, Inspector's Test Fittings:
1. Fire-End and Croker Corp.
 2. G/J Innovations, Inc.
 3. Triple R Specialty of Ajax, Inc.
- F. Fire Department Connections:
1. Badger Fire Protection, Inc.
 2. Elkhart Brass Mfg. Co., Inc.
 3. Fire-End and Croker Corp.
 4. Firematic Sprinkler Devices, Inc.
 5. Grinnell Corp.
 6. Guardian Fire Equipment, Inc.
 7. Reliable Automatic Sprinkler Co., Inc.
 8. Smith Industries, Inc.; Potter-Roemer Div.
- G. Sprinklers:
1. Badger Fire Protection, Inc.
 2. Central Sprinkler Corp.
 3. Firematic Sprinkler Devices, Inc.
 4. Globe Fire Sprinkler Corp.
 5. Grinnell Corp.
 6. Reliable Automatic Sprinkler Co., Inc.
 7. Star Sprinkler Corp.
 8. Viking Corp.
- H. Indicator Valves:
1. Central Sprink, Inc.
 2. Grinnell Corp.
 3. McWane, Inc.; Kennedy Valve Div.
 4. Milwaukee Valve Co., Inc.
 5. Nibco, Inc.
 6. Victaulic Co. of America.
- I. Indicator Posts and Indicator-Post, Gate Valves:
1. American Cast Iron Pipe Co.; Waterous Co.
 2. Grinnell Corp.
 3. McWane, Inc.; Clow Valve Co. Div.
 4. McWane, Inc.; Kennedy Valve Div.
 5. Nibco, Inc.
 6. Stockham Valves & Fittings, Inc.
- J. Fire-Protection-Service Valves:
1. Central Sprink, Inc.
 2. Central Sprinkler Corp.
 3. Grinnell Corp.
 4. McWane, Inc.; Kennedy Valve Div.
 5. Nibco, Inc.
 6. Stockham Valves & Fittings, Inc.
 7. Victaulic Co. of America.
- K. Keyed Couplings for Steel Piping:
1. Central Sprink, Inc.
 2. Ductilic, Inc.

3. Grinnell Corp.
4. National Fittings, Inc.
5. Star Pipe Products, Inc.; Star Fittings Div.
6. Victaulic Co. of America.

- L. Keyed Couplings for Ductile-Iron Piping:
1. Victaulic Co. of America.

- M. Mechanically Formed Tee Outlets:
1. T-Drill Industries, Inc.

PIPING MATERIALS:

Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

PIPES AND TUBES:

Ductile-Iron Pipe: AWWA C151, push-on-joint type; with cement-mortar lining and seal coat according to AWWA C104. Include rubber gasket according to AWWA C111.

Ductile-Iron Pipe: AWWA C151, mechanical-joint type; with cement-mortar lining and seal coat according to AWWA C104. Include gland, rubber gasket, and bolts and nuts according to AWWA C111.

Ductile-Iron Pipe: AWWA C115 or AWWA C151, with cement-mortar lining and seal coat according to AWWA C104 and ends factory or field, radius-cut grooved according to AWWA C606.

Standard-Weight Steel Pipe: ASTM A 53, ASTM A 135, or ASTM A 795; Schedule 40 in NPS 6 (DN150) and smaller, and Schedule 30 in NPS 8 (DN200) and larger.

Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 (DN125) and smaller and NFPA 13 specified wall thickness in NPS 6 to NPS 10 (DN150 to DN250).

CPVC Pipe: ASTM F 442 and UL 1821, 175-psig (1200-kPa) pressure rating; and made for sprinkler service. Include "Listed" and "CPVC Sprinkler Pipe" markings.

PIPE AND TUBE FITTINGS:

Ductile-Iron Fittings: AWWA C110, ductile-iron or cast-iron push-on-joint type; or AWWA C153, ductile-iron, compact push-on-joint type. Include cement-mortar lining and seal coat according to AWWA C104 and rubber gaskets according to AWWA C111.

Ductile-Iron Fittings: AWWA C110, ductile-iron or cast-iron type; or AWWA C153, ductile-iron, compact mechanical-joint type. Include cement-mortar lining and seal coat according to AWWA C104 and glands, rubber gaskets, and bolts and nuts according to AWWA C111.

Ductile-Iron Fittings: ASTM A 47 (ASTM A 47M), malleable-iron or ASTM A 536, ductile-iron casting complying with AWWA pipe size; with ends factory grooved according to AWWA C606. Include cement-mortar lining and seal coat according to AWWA C104 or epoxy, interior coating according to AWWA C550.

Ductile-Iron Fittings: ASTM A 47 (ASTM A 47M), malleable-iron or ASTM A 536, ductile-iron casting complying with AWWA pipe size; with ends factory grooved according to AWWA C606.

Cast-Iron Threaded Flanges: ASME B16.1.

Cast-Iron Threaded Fittings: ASME B16.4.

Malleable-Iron Threaded Fittings: ASME B16.3.

Steel, Threaded Couplings: ASTM A 865.

Steel Welding Fittings: ASTM A 234/A 234M, ASME B16.9, or ASME B16.11.

Steel Flanges and Flanged Fittings: ASME B16.5.

Steel, Grooved-End Fittings: UL-listed and FM-approved, ASTM A 47 (ASTM A 47M), malleable iron or ASTM A 536, ductile iron; with dimensions matching steel pipe and ends factory grooved according to AWWA C606.

CPVC Fittings: ASTM F 438 and UL 1821 for NPS 3/4 to NPS 1-1/2 (DN20 to DN40) and ASTM F 439 and UL 1821 for NPS 2 to NPS 3 (DN50 to DN80), UL-listed, 175-psig (1200-kPa) pressure rating; and made for sprinkler service. Include "Listed" and "CPVC Sprinkler Fitting" markings.

JOINING MATERIALS:

Refer to Division 22 Section "Basic Mechanical Materials and Methods" for pipe-flange gasket materials and welding filler metals.

Ductile-Iron, Keyed Couplings: UL 213 and AWWA C606, for ductile-iron pipe dimensions. Include ASTM A 536, ductile-iron housing, rubber gaskets, and steel bolts and nuts.

Ductile-Iron, Flanged Joints: AWWA C115, ductile-iron or gray-iron pipe flanges, rubber gaskets, and steel bolts and nuts.

Steel, Keyed Couplings: UL 213 and AWWA C606, for steel-pipe dimensions. Include ASTM A 536, ductile-iron housing, rubber gaskets, and steel bolts and nuts. Include listing for dry-pipe service for couplings for dry piping.

Brazing Filler Metals: AWS A5.8, Classification BCuP-3 or BCuP-4.

Copper, Keyed Couplings: UL 213 and equivalent to AWWA C606, for copper-tube dimensions. Include ASTM A 47 (ASTM A 47M), malleable-iron or ASTM A 536, ductile-iron housing with copper-colored enamel finish, rubber gaskets, and steel bolts and nuts.

CPVC Cement: Primer and solvent cement made by pipe and fitting manufacturer for joining CPVC sprinkler piping.

Transition Couplings: AWWA C219, sleeve type, or other manufactured fitting the same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

POLYETHYLENE ENCASEMENT:

Polyethylene Encasement for Ductile-Iron Piping: ASTM A 674 or AWWA C105, film, 0.008-inch (0.20-mm) minimum thickness, tube or sheet.

GENERAL-DUTY VALVES:

Refer to Division 22 Section "Valves" for gate, ball, butterfly, globe, and check valves not required to be UL listed and FM approved.

FIRE-PROTECTION-SERVICE VALVES:

General: UL listed and FM approved, with minimum 175-psig (1200-kPa) non-shock working-pressure rating. Valves for grooved-end piping may be furnished with grooved ends instead of type of ends specified.

Gate Valves, NPS 2 (DN50) and Smaller: UL 262; cast-bronze, threaded ends; solid wedge; OS&Y; and rising stem.

Indicating Valves, NPS 2-1/2 (DN65) and Smaller: UL 1091; butterfly or ball-type, bronze body with threaded ends; and integral indicating device.

Indicator: Visual.

- A. Indicator: Electrical 115-V ac, prewired, single-circuit, supervisory switch.
- B. Indicator: Electrical 115-V ac, prewired, two-circuit, supervisory switch.

Gate Valves, NPS 2-1/2 (DN65) and Larger: UL 262, iron body, bronze mounted, taper wedge, OS&Y, and rising stem. Include replaceable, bronze, wedge facing rings and flanged ends.

Indicator-Post, Gate Valves: UL 262, iron body, bronze mounted, solid-wedge disc, and nonrising stem with operating nut and flanged ends.

Indicator Posts: UL 789, horizontal, wall type, cast-iron body, with windows for target plates that indicate valve position, extension rod and coupling, locking device, and red enamel finish.

- A. Operation: Operating wrench.
- B. Operation: Hand wheel.

Swing Check Valves, NPS 2 (DN50) and Smaller: UL 312 or MSS SP-80, Class 150; bronze body with bronze disc and threaded ends.

Swing Check Valves, NPS 2-1/2 (DN65) and Larger: UL 312, cast-iron body and bolted cap, with bronze disc or cast-iron disc with bronze-disc ring and flanged ends.

Split-Clapper Check Valves, NPS 4 (DN100) and Larger: UL 312, cast-iron body with rubber seal, bronze-alloy discs, and stainless-steel spring and hinge pin.

SPECIALTY VALVES:

Alarm Check Valves: UL 193, 175-psig (1200-kPa) working pressure, designed for horizontal or vertical installation, with cast-iron flanged inlet and outlet, bronze grooved seat with O-ring seals, and single-hinge pin and latch design. Include trim sets for bypass, drain, electric sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.

- A. Option: Grooved-end connections for use with keyed couplings.
- B. Drip Cup Assembly: Pipe drain without valves, and separate from main drain piping.

Dry-Pipe Valves: UL 260; differential type; 175-psig (1200-kPa) working pressure; with cast-iron flanged inlet and outlet, bronze seat with O-ring seals, and single-hinge pin and latch design. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

- A. Option: Grooved-end connections for use with keyed couplings.
- B. Air-Pressure Maintenance Devices: Automatic device to maintain correct air pressure in piping. Include shutoff valves to permit servicing without shutting down sprinkler piping,

bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range, and 175-psig (1200-kPa) maximum inlet pressure.

- C. Air Compressor: Fractional horsepower, 120-V ac, 60 Hz, single phase.

Pressure-Regulating Valves: UL 1468, 400-psig (2760-kPa) minimum rating, brass. Include NPS 1-1/2 or NPS 2-1/2 (DN40 or DN65), female NPS inlet and outlet; adjustable setting feature; and straight or 90-degree angle pattern design as indicated.

- A. Finish: Rough chrome-plated.

Ball Drip Valves: UL 1726, automatic drain valve, NPS 3/4 (DN20), ball check device with threaded ends.

SPRINKLERS:

Automatic Sprinklers: With heat-responsive element complying with the following:

- A. UL 199, for applications except residential.
- B. UL 1626, for residential applications.
- C. UL 1767, for early suppression, fast-response applications.

Sprinkler Types and Categories: Nominal 1/2-inch (12.7-mm) orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.

Sprinkler types, features, and options include the following:

- A. Concealed ceiling sprinklers, including cover plate.
- B. Extended-coverage sprinklers.
- C. Flow-control sprinklers, with automatic open and shutoff feature.
- D. Flush ceiling sprinklers, including escutcheon.
- E. Pendent sprinklers.
- F. Pendent, dry-type sprinklers.
- G. Quick-response sprinklers.
- H. Recessed sprinklers, including escutcheon.
- I. Sidewall, dry-type sprinklers.
- J. Upright sprinklers.
- K. Sidewall sprinklers.
- L. Institution sprinklers, made with small, breakaway projection.

Sprinkler Finishes: Chrome-plated, bronze, and painted.

Special Coatings: Wax, lead, and corrosion-resistant paint.

Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

- A. Ceiling Mounting: Chrome-plated steel, one piece, flat.
- B. Ceiling Mounting: Chrome-plated steel, two piece, with 1-inch (25-mm) vertical adjustment.
- C. Sidewall Mounting: Chrome-plated steel, one piece, flat.

Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler. Provide on all exposed pendent or upright sprinklers in gymnasiums and athletic spaces.

SPECIALTY SPRINKLER FITTINGS:

Specialty Fittings: UL listed and FM approved; made of steel, ductile iron, or other materials compatible with piping.

Dry-Pipe-System Fittings: UL listed for dry-pipe service.

Locking-Lug Fittings: UL 213, ductile-iron body with locking-lug ends.

Mechanical-T Fittings: UL 213, ductile-iron housing with pressure-responsive gasket, bolts, and threaded or locking-lug outlet.

Mechanical-Cross Fittings: UL 213, ductile-iron housing with pressure-responsive gaskets, bolts, and threaded or locking-lug outlets.

Drop-Nipple Fittings: UL 1474, with threaded inlet, threaded outlet, and seals; adjustable.

Sprinkler, Drain and Alarm Test Fittings: UL-listed, cast- or ductile-iron body; with threaded inlet and outlet, test valve, and orifice and sight glass.

Sprinkler, Branch-Line Test Fittings: UL-listed, brass body; with threaded inlet and capped drain outlet and threaded outlet for sprinkler.

Sprinkler, Inspector's Test Fittings: UL-listed, cast- or ductile-iron housing; with threaded inlet and drain outlet and sight glass.

FIRE DEPARTMENT CONNECTIONS:

Exposed, Freestanding, Fire Department Connections: UL 405, cast-brass body, inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, and bottom outlet with pipe threads. Include brass, lugged caps, gaskets, and brass chains; brass, lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- (460-mm-) high brass sleeve; and round, floor, brass, escutcheon plate with marking "AUTO SPKR."

A. Finish Including Sleeve: Polished chrome-plated.

ALARM DEVICES:

General: Types matching piping and equipment connections.

Water-Motor-Operated Alarms: UL 753, mechanical-operation type with pelton-wheel operator with shaft length, bearings, and sleeve to suit wall construction and 10-inch- (250-mm-) diameter, cast-aluminum alarm gong with red-enamel factory finish. Include NPS 3/4 (DN20) inlet and NPS 1 (DN25) drain connections.

Water-Flow Indicators: UL 346; electrical-supervision, vane-type water-flow detector; with 250-psig (1725-kPa) 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.

Pressure Switches: UL 753; electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.

Valve Supervisory Switches: UL 753; electrical; single-pole, double throw; with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

Indicator-Post Supervisory Switches: UL 753; electrical; single-pole, double throw, with normally closed contacts. Include design that signals controlled indicator-post valve is in other than fully open position.

PRESSURE GAGES:

Pressure Gages: UL 393, 3-1/2- to 4-1/2-inch- (90- to 115-mm-) diameter dial with dial range of 0 to 250 psig (0 to 1725 kPa).

PART 3 EXECUTION

PREPARATION:

Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article in Part 1 of this Section.

Report test results promptly and in writing.

EARTHWORK:

Refer to Division 33 Section "Earthwork" for excavating, trenching, and backfilling.

PIPING APPLICATIONS:

Do not use welded joints with galvanized steel pipe.

Flanges, unions, and transition and special fittings with pressure ratings the same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

Piping between Fire Department Connections and Check Valves: Use galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.

Piping between Fire Department Connections and Check Valves: Use galvanized, standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.

Underground Service-Entrance Piping: Use ductile-iron, push-on-joint pipe and fittings and restrained joints.

Underground Service-Entrance Piping: Use ductile-iron, mechanical-joint pipe and fittings and restrained joints.

Sprinkler Feed Mains and Risers: Use the following:

- A. NPS 4 (DN100) and Smaller: Standard-weight steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
- B. NPS 4 (DN100) and Smaller: Standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- C. NPS 4 (DN100) and Smaller: Standard-weight steel pipe with plain ends, steel welding fittings, and welded joints.
- D. NPS 4 (DN100) and Smaller: Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
- E. NPS 4 (DN100) and Smaller: Galvanized, standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.

- F. NPS 5 and NPS 6 (DN125 and DN150): Standard-weight steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
- G. NPS 5 and NPS 6 (DN125 and DN150): Standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- H. NPS 5 and NPS 6 (DN125 and DN150): Standard-weight steel pipe with plain ends, steel welding fittings, and welded joints.
- I. NPS 5 and NPS 6 (DN125 and DN150): Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
- J. NPS 5 and NPS 6 (DN125 and DN150): Galvanized, standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.

Sprinkler Branch Piping: Use the following:

Wet-Pipe, Sprinkler Branch Piping: Use the following:

- A. Sprinkler-Piping Option: Mechanical-T bolted-branch-outlet fittings, NPS 2 (DN50) and smaller, may be used downstream from sprinkler zone valves.
- B. Sprinkler-Piping Option: Specialty sprinkler fittings, NPS 2 (DN50) and smaller, including mechanical-T fittings, may be used downstream from sprinkler zone valves.
- C. NPS 2 (DN50) and Smaller: Schedule 10 steel pipe with roll-grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- D. NPS 2 (DN50) and Smaller: Schedule 10 steel pipe with plain ends, steel welding fittings, and welded joints.
- E. NPS 2 (DN50): CPVC pipe, CPVC fittings, and solvent-cement joints.
- F. NPS 4 (DN100) and Smaller: Standard-weight steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
- G. NPS 4 (DN100) and Smaller: Standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- H. NPS 4 (DN100) and Smaller: Standard-weight steel pipe with plain ends, steel welding fittings, and welded joints.

Dry-Pipe Sprinklers: Use the following:

- A. Sprinkler-Piping Option: Mechanical-T bolted-branch-outlet fittings, NPS 2 (DN50) and smaller, may be used downstream from sprinkler zone valves.
- B. Sprinkler-Piping Option: Specialty sprinkler fittings, NPS 2 (DN50) and smaller, including mechanical-T fittings, may be used downstream from sprinkler zone valves.
- C. NPS 4 (DN100) and Smaller: Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
- D. NPS 4 (DN100 and Smaller): Galvanized, standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.

VALVE APPLICATIONS:

Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

- A. Fire-Protection-Service Valves: UL listed and FM approved for applications where required by NFPA 13.
 - 1. Shutoff Duty: Use gate valves.
- B. General-Duty Valves: For applications where UL-listed and FM-approved valves are not required by NFPA 13.
 - 1. Shutoff Duty: Use gate, ball, or butterfly valves.
 - 2. Throttling Duty: Use globe, ball, or butterfly valves.

JOINT CONSTRUCTION:

Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

Ductile-Iron-Piping, Grooved Joints: Use ductile-iron pipe with radius-cut-grooved ends; ductile-iron, grooved-end fittings; and ductile-iron, keyed couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.

Steel-Piping, Grooved Joints: Use Schedule 40 steel pipe with cut or roll-grooved ends and Schedule 30 or thinner steel pipe with roll-grooved ends; steel, grooved-end fittings; and steel, keyed couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions. Use gaskets listed for dry-pipe service for dry piping.

Mechanically Formed, Copper-Tube-Outlet Joints: Use UL-listed tool and procedure and follow forming equipment manufacturer's written instructions. Drill pilot hole in copper tube, form branch for collar, dimple tube to form seating stop, and braze branch tube into formed-collar outlet.

Locking-Lug-Fitting, Twist-Locked Joints: Follow fitting manufacturer's written instructions.

Dissimilar-Piping-Material Joints: Construct joints using adapters or couplings compatible with both piping materials. Use dielectric fittings if both piping materials are metal. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for dielectric fittings.

Handling of Cleaners, Primers, and Solvent Cements for CPVC Pipe: Comply with procedures in ASTM F 402 for safe handling when joining CPVC piping with solvent cements.

SERVICE-ENTRANCE PIPING:

Connect sprinkler piping to water-service piping of size and in location indicated for service entrance to building. Refer to Division 33 Section "Water Distribution" for exterior piping.

Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Refer to Division 33 Section "Water Distribution" for backflow preventers.

Install shutoff valve, check valve, pressure gage, drain, and other accessories at connection to water service.

WATER-SUPPLY CONNECTION:

Connect sprinkler piping to building interior water distribution piping. Refer to Division 22 Section "Water Distribution Piping" for interior piping.

Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water distribution piping. Refer to Division 22 Section "Plumbing Specialties" for backflow preventers.

Install shutoff valve, check valve, pressure gage, drain, and other accessories at connection to water service.

PIPING INSTALLATION:

Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping installation.

Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location

and arrangement of piping. Install piping as indicated, as far as practical.

- A. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

Install underground service-entrance piping according to NFPA 24 and with restrained joints.

Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

Install unions adjacent to each valve in pipes NPS 2 (DN50) and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 (DN65) and larger connections.

Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve, sized and located according to NFPA 13.

Install sprinkler piping with drains for complete system drainage.

Install sprinkler zone control valves, test assemblies, and drain risers adjacent to sprinkler risers when sprinkler branch piping is connected to sprinkler risers.

Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.

Install alarm devices in piping systems.

Hangers and Supports: Comply with NFPA 13 for hanger materials and installation.

Install piping with grooved joints according to manufacturer's written instructions. Construct rigid piping joints, unless otherwise indicated.

Install pressure gages on riser or feed main and at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 (DN8) 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.

SPECIALTY SPRINKLER FITTING INSTALLATION:

Install specialty sprinkler fittings according to manufacturer's written instructions.

VALVE INSTALLATION:

Refer to Division 22 Section "Valves" for installing general-duty valves. Install fire-protection specialty valves, trim, fittings, controls, and specialties according to NFPA 13, manufacturer's written instructions, and authorities having jurisdiction.

Gate Valves: Install fire-protection-service valves supervised-open, located to control sources of water supply except from fire department connections. Provide permanent identification signs indicating portion of system controlled by each valve.

Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.

Alarm Check Valves: Install valves in vertical position for proper direction of flow, including bypass check valve and retard chamber drain-line connection.

Dry-Pipe Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

- A. Air-Pressure Maintenance Devices for Dry-Pipe Systems: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range; and 175-psig (1200-kPa) maximum inlet pressure.
- B. Install air compressor and compressed-air supply piping.

SPRINKLER APPLICATIONS:

General: Use sprinklers according to the following applications:

- A. Rooms without Ceilings: Upright or pendent sprinklers with wire guards as required.
- B. Rooms with Ceilings: Concealed sprinklers.
- C. Rooms with Wood Ceilings: Concealed sprinklers with custom color cover.
- D. Wall Mounting: Sidewall sprinklers.
- E. Spaces Subject to Freezing: Upright; pendent, dry-type; and sidewall, dry-type sprinklers.
- F. Special Applications: Use extended-coverage, flow-control, and quick-response sprinklers where indicated.
- G. Secured Ceilings: Concealed sprinklers.
- H. Sprinkler Finishes: Use sprinklers with the following finishes:
 - 1. Upright, Pendent, and Sidewall Sprinklers: Chrome-plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.
 - 2. Concealed Sprinklers: Rough brass, with factory-painted white or custom colored cover plate.

SPRINKLER INSTALLATION:

Install sprinklers in patterns indicated.

Install sprinklers in suspended ceilings in center of acoustical panels and tiles.

Install sprinklers in suspended ceilings in center of narrow dimension of acoustical panels.

Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

CONNECTIONS:

Connect water-supply piping and sprinklers to fire pumps. Include backflow preventers.

Connect water supplies to sprinklers. Include backflow preventers.

Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.

Connect piping to specialty valves, specialties, fire department connections, and accessories.

Electrical Connections: Power wiring is specified in Division 26.

Connect alarm devices to fire alarm.

Connect compressed-air supply to dry-pipe sprinkler piping.

Connect air compressor to the following piping and wiring:

- A. Pressure gages and controls.
- B. Electrical power system.
- C. Fire alarm system devices, including low-pressure alarm.

LABELING AND IDENTIFICATION:

Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and in Division 22 Section "Mechanical Identification."

FIELD QUALITY CONTROL:

Flush, test, and inspect sprinkler piping according to NFPA 13, "System Acceptance" Chapter.

Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.

Report test results promptly and in writing to Architect and authorities having jurisdiction.

CLEANING:

Clean dirt and debris from sprinklers.

Remove and replace sprinklers having paint other than factory finish.

PROTECTION:

Protect sprinklers from damage until Substantial Completion.

COMMISSIONING:

Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.

Verify that air compressors and their accessories are installed and operate correctly.

Verify that specified tests of piping are complete.

Verify that damaged sprinklers and sprinklers with paint or coating not specified are replaced with new, correct type.

Verify that sprinklers are correct types, have correct finishes and temperature ratings, and have guards as required for each application.

Verify that potable-water supplies have correct types of backflow preventers.

Drain dry-pipe sprinkler piping.

Pressurize and check dry-pipe sprinkler piping air-pressure maintenance devices and air compressors.

Verify that fire department connections have threads compatible with local fire department equipment.

Fill wet-pipe sprinkler piping with water.

Energize circuits to electrical equipment and devices.

Start and run air compressors.

Adjust operating controls and pressure settings.

Coordinate with fire alarm tests. Operate as required.

DEMONSTRATION:

Demonstrate equipment, specialties, and accessories. Review operating and maintenance information.

Schedule demonstration with Owner with at least seven days' advance notice.

END OF SECTION

22 05 05 PLUMBING GENERAL PROVISIONS

PART 1 GENERAL**GENERAL INFORMATION:**

The General Requirements and Supplementary Conditions are part of this contract and govern work under this division.

SCOPE OF WORK:

Work by Mechanical Contractor: Provide all mechanical systems indicated by the drawings, specified or as instructed otherwise. Unless specified otherwise, provide all labor, materials and equipment necessary to provide a complete and operational system.

Work by Electrical Contractor: Provide all line voltage wiring and install items of equipment furnished by the Mechanical, such as thermostats, remote control panels, etc.

Mechanical and Electrical Coordination: The Mechanical will provide to the Electrical all manufacturer's wiring diagrams and installation data and locate all equipment furnished to the Electrical.

Where work or materials are specified or shown on drawings to be performed by more than one Contractor, each such Contractor will be deemed to have figured the item and the Architect will determine who shall furnish the work and who shall submit the credit to the Owner.

Work by General Contractor: Provide all openings and chases with proper framing and reinforcing as required for Mechanical equipment.

Provide access panels or doors where required for mechanical systems.

Provide concrete pads for all base mounted mechanical equipment.

DEFINITIONS:

Contractor: The contractor performing work under this Division of the Specifications.

Provide: Contractor is responsible to furnish and install component completely.

QUALITY ASSURANCE:

Manufacturers: Acceptable manufacturers are listed in applicable sections of the Specifications and on the drawings.

Drawings and Specifications are complimentary. Requirements indicated in either are binding and the most stringent is to be used.

The Contractor is to review documents for the work, and if any discrepancies occur between the work of this Division and the work of another Division, is to notify the Architect and obtain written instructions for any changes necessary. Any changes in the work by this Division made necessary by the failure or neglect of the Contractor to report such discrepancies will be made by, and at the expense of the Contractor.

Changes in Design or Installation: Refer to the General and Supplementary Conditions for requirements pertaining to changes in design and installation. Mechanical installation will otherwise be in accordance with the Contract Drawings and Specifications.

REGULATORY AGENCIES:

Permits and Fees: The Contractor is to pay for all permits and fees as required by Local or State regulatory agencies.

Codes: Work for this project is to comply with Federal, State and Local codes, ordinances and regulations. All work shall comply the latest adopted edition of the Building Code and associated sections of the National Fire Protection Association.

Work shall be done according to applicable codes in cases of conflict between specifications, plans and codes, except where plans and specifications call for higher standards than the codes.

SUBMITTALS AND SHOP DRAWINGS:

Submit product data and copies of shop drawings for all major pieces of equipment as indicated in the respective sections of this Division.

The intent of shop drawing submittals by the Contractor is to demonstrate to the Architect / Engineer that the Contractor understands the design concept and demonstrates his understanding by indicating and detailing the fabrication and installation methods to be used.

If deviations, discrepancies or conflicts between shop drawing submittals and Contract Documents are discovered either prior to or after shop drawing submittals are processed, the design drawings and specifications shall take precedence.

The Architect / Engineer shall review shop drawings for general conformance with the design concept of the project. The review shall not relieve the Contractor of the responsibility of compliance with the contract documents or errors in the shop drawings.

PRODUCT DELIVERY, STORAGE AND HANDLING:

Make provisions for the delivery and safe storage of all material and make the required arrangements with other trades to coordinate moving large pieces of equipment into the building.

Where materials are indicated to be "Furnished by Others" to the Contractor for installation, these materials shall be checked and their delivery properly receipted. After delivery the Contractor assumes all responsibility for the safekeeping of such equipment.

All materials stored outside are to be covered and protected with weatherproof material.

JOB CONDITIONS:

Verify existing site conditions and location prior to bidding.

Verify existing utilities and the actual location of in reference to location of such as shown on drawings. Any deviations between actual conditions and plan locations will be reviewed with the Architect. Repair, patch or terminate utilities encountered in an acceptable manner regardless of whether shown or not.

GUARANTEE:

The Contractor is to guarantee all materials, equipment, workmanship and operation of all systems for a period of one (1) year from the date of final acceptance of the entire project. Guarantee to repair or replace at Contractor's expense any art of the work which may be defective during that time provided that such defect is, in the opinion of the Architect / Engineer, due to imperfect material or workmanship and not to carelessness or improper use.

PART 2 PRODUCTS

STANDARDS FOR EQUIPMENT AND MATERIALS:

All material shall be labeled UL, ETL, AGA or other approved independent testing authority.

All pressure rated vessels shall be provided with an ASME stamp, meeting the ASME Code or the Local Authority, whichever is most stringent.

All materials and equipment shall be of the best quality and be new, unused and without damage.

System design is based upon the first manufacturer listed in the Specifications and the other named manufacturers are considered equivalent. Any costs attributed in changes in ductwork, piping, plumbing, space clearances or other trades is to be borne by the Contractor when another manufacturer is used in lieu of the first listed.

MATERIALS OF APPROVED EQUAL:

Unless request for changes in base bid specifications are received and approved ten (10) days prior to the opening of bids, the successful Contractor will be held to furnish specified items under base bid.

PART 3 EXECUTION

PREPARATION:

Base final installation of all materials and equipment on field dimensions and conditions at the building. The Mechanical Contractor is to inspect all work that affects the work of this Division and report any deficiencies to the General Contractor and Architect. No extra compensation will be allowed on account of minor differences in actual dimensions and those indicated on the plans.

INSTALLATION:

Workmanship: Perform all work in accordance with good commercial practice.

Supervision: The superintendent shall be responsible for the work of this Division and of all subcontractors under this Division. All questions or directions will be directed through the superintendent.

Installation Procedures:

- A. Field verify exact location, size, routing, elevation and accessibility of existing and new HVAC and plumbing systems.
- B. Properly size and locate all anchors, chases, recesses and openings required for the proper installation of the work.

- C. Piping and equipment located in areas subject to low temperatures shall be installed in a manner to prevent freezing.
- D. All equipment and materials are to be installed as high as possible.
- E. Install equipment and systems in accordance with manufacturer's recommends, accepted industry standards and all applicable Codes.

END OF SECTION

22 05 06 BASIC PLUMBING MATERIALS AND METHODS

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes the following basic mechanical materials and methods to complement other Division 22 Sections.

- A. Piping materials and installation instructions common to most piping systems.
- B. Concrete base construction requirements.
- C. Escutcheons.
- D. Dielectric fittings.
- E. Flexible connectors.
- F. Mechanical sleeve seals.
- G. Equipment nameplate data requirements.
- H. Labeling and identifying mechanical systems and equipment is specified in Division 22 Section "Mechanical Identification."
- I. Non-shrink grout for equipment installations.
- J. Field-fabricated metal and wood equipment supports.
- K. Installation requirements common to equipment specification sections.
- L. Mechanical demolition.
- M. Cutting and patching.
- N. Touchup painting and finishing.

Plumbing pipe and pipe fitting materials are specified in Division 22 piping system Sections.

DEFINITIONS:

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, crawl spaces, and tunnels.

Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

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.

The following are industry abbreviations for plastic materials:

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. CPVC: Chlorinated polyvinyl chloride plastic.
- C. NP: Nylon plastic.
- D. PE: Polyethylene plastic.
- E. PVC: Polyvinyl chloride plastic.

The following are industry abbreviations for rubber materials:

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. EPDM: Ethylene propylene diene terpolymer rubber.

SUBMITTALS:

Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.

Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

Coordination Drawings: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:

- A. Planned piping layout, including valve and specialty locations and valve-stem movement.
- B. Clearances for installing and maintaining insulation.
- C. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
- D. Equipment and accessory service connections and support details.
- E. Exterior wall and foundation penetrations.
- F. Fire-rated wall and floor penetrations.
- G. Sizes and location of required concrete pads and bases.
- H. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
- I. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
- J. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.
- K. Access panel and door locations.

QUALITY ASSURANCE:

Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

DELIVERY, STORAGE, AND HANDLING:

Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

Protect flanges, fittings, and piping specialties from moisture and dirt.

Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

SEQUENCING AND SCHEDULING:

Coordinate mechanical equipment installation with other building components.

Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors."

Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS**MANUFACTURERS:**

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Dielectric Unions:
 - 1. Capitol Manufacturing Co.
 - 2. Central Plastics Co.
 - 3. Eclipse, Inc.; Rockford-Eclipse Div.
 - 4. Epco Sales Inc.
 - 5. Hart Industries International, Inc.
 - 6. Watts Industries, Inc.; Water Products Div.
 - 7. Zurn Industries, Inc.; Wilkins Div.

- B. Dielectric Flanges:
 - 1. Capitol Manufacturing Co.
 - 2. Central Plastics Co.
 - 3. Epco Sales Inc.
 - 4. Watts Industries, Inc.; Water Products Div.
- C. Dielectric-Flange Insulating Kits:
 - 1. Calpico, Inc.
 - 2. Central Plastics Co.
- D. Dielectric Couplings:
 - 1. Calpico, Inc.
 - 2. Lochinvar Corp.
- E. Dielectric Nipples:
 - 1. Grinnell Corp.; Grinnell Supply Sales Co.
 - 2. Perfection Corp.
 - 3. Victaulic Co. of America.
- F. Metal, Flexible Connectors:
 - 1. ANAMET Industrial, Inc.
 - 2. Central Sprink, Inc.
 - 3. Flexicraft Industries.
 - 4. Flex-Weld, Inc.
 - 5. Grinnell Corp.; Grinnell Supply Sales Co.
 - 6. Hyspan Precision Products, Inc.
 - 7. McWane, Inc.; Tyler Pipe; Gustin-Bacon Div.
 - 8. Mercer Rubber Co.
 - 9. Metraflex Co.
 - 10. Proco Products, Inc.
 - 11. Uniflex, Inc.
 - 12. Flexonics.
- G. Mechanical Sleeve Seals:
 - 1. Calpico, Inc.
 - 2. Metraflex Co.
 - 3. Thunderline/Link-Seal.

PIPE AND PIPE FITTINGS:

Refer to individual Division 22 piping Sections for pipe and fitting materials and joining methods.

Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

JOINING MATERIALS:

Refer to individual Division 22 piping Sections for special joining materials not listed below.

Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

- A. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness, unless

thickness or specific material is indicated.

1. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
2. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

- B. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

Solder Filler Metals: ASTM B 32.

- A. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
- B. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.

Brazing Filler Metals: AWS A5.8.

- A. BCuP Series: Copper-phosphorus alloys.
- B. BAg1: Silver alloy.

Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

Solvent Cements: Manufacturer's standard solvent cements for the following:

- A. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

Plastic Pipe Seals: ASTM F 477, elastomeric gasket.

Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.

- A. Sleeve: ASTM A 126, Class B, gray iron.
- B. Followers: ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 536 ductile iron.
- C. Gaskets: Rubber.
- D. Bolts and Nuts: AWWA C111.
- E. Finish: Enamel paint.

DIELECTRIC FITTINGS:

General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

Insulating Material: Suitable for system fluid, pressure, and temperature.

Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

- A. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

FLEXIBLE CONNECTORS:

General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig (860-kPa) minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:

- A. 2-Inch NPS (DN50) and Smaller: Threaded.
- B. 2-1/2-Inch NPS (DN65) and Larger: Flanged.
- C. Option for 2-1/2-Inch NPS (DN65) and Larger: Grooved for use with keyed couplings.

Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

MECHANICAL SLEEVE SEALS:

Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

PIPING SPECIALTIES:

Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

- A. Steel Sheet Metal: 0.0239-inch (0.6-mm) minimum thickness, galvanized, round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade A, 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.

Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.

- A. ID: Closely fit around pipe, tube, and insulation of insulated piping.
- B. OD: Completely cover opening.
- C. Cast Brass: One piece, with set screw.
 1. Finish: Rough brass.
 2. Finish: Polished chrome-plate.
- D. Cast Brass: Split casting, with concealed hinge and set screw.
 1. Finish: Rough brass.
 2. Finish: Polished chrome-plate.
- E. Stamped Steel: One piece, with set screw and chrome-plated finish.
- F. Stamped Steel: One piece, with spring clips and chrome-plated finish.
- G. Stamped Steel: Split plate, with concealed hinge, set screw, and chrome-plated finish.
- H. Stamped Steel: Split plate, with concealed hinge, spring clips, and chrome-plated finish.
- I. Stamped Steel: Split plate, with exposed-rivet hinge, set screw, and chrome-plated finish.
- J. Stamped Steel: Split plate, with exposed-rivet hinge, spring clips, and chrome-plated finish.
- K. Cast-Iron Floor Plate: One-piece casting.

GROUT:

Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.

- A. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
- B. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- C. Packaging: Premixed and factory packaged.

PART 3 EXECUTION

PIPING SYSTEMS - COMMON REQUIREMENTS:

General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 22 piping Sections specify unique piping installation requirements.

General Locations and Arrangements: 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.

Install piping at indicated slope.

Install components with pressure rating equal to or greater than system operating pressure.

Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

Install piping free of sags and bends.

Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation.

Locate groups of pipes parallel to each other, spaced to permit valve servicing.

Install fittings for changes in direction and branch connections.

Install couplings according to manufacturer's written instructions.

Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

- A. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
- B. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
- C. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
- D. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
- E. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.

Sleeves are not required for core drilled holes.

Permanent sleeves are not required for holes formed by PE removable sleeves.

Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.

Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

- A. Cut sleeves to length for mounting flush with both surfaces.
 - 1. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
- B. Build sleeves into new walls and slabs as work progresses.
- C. Install sleeves large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - 1. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS (DN150).
 - 2. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS (DN150) and larger, penetrating gypsum-board partitions.
 - 3. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
 - a. Seal space outside of sleeve fittings with non-shrink, nonmetallic grout.

- D. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 7 Section "Joint Sealants" for materials.
- E. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

- A. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
- B. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) in diameter and larger.
- C. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

- A. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 7 Section "Firestopping" for materials.

Verify final equipment locations for roughing-in.

Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

- 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. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 - 2. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
 - 3. Align threads at point of assembly.
 - 4. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
 - 5. 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.

- F. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
- G. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
- H. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. 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. PVC Pressure Piping: ASTM D 2672.
 - 3. PVC Non-pressure Piping: ASTM D 2855.

Piping Connections: Make connections according to the following, unless otherwise indicated:

- A. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.
- B. Install flanges, in piping 2-1/2-inch NPS (DN65) and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
- C. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
- D. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

EQUIPMENT INSTALLATION - COMMON REQUIREMENTS:

Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.

Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

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.

Install equipment giving right of way to piping installed at required slope.

Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

PAINTING AND FINISHING:

Refer to Division 9 Section "Painting" for paint materials, surface preparation, and application of paint.

Apply paint to exposed piping according to the following, unless otherwise indicated:

- A. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
- B. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
- C. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
- D. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
- E. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
- F. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

Do not paint piping specialties with factory-applied finish.

Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

CONCRETE BASES:

Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

ERECTION OF METAL SUPPORTS AND ANCHORAGE:

Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

ERECTION OF WOOD SUPPORTS AND ANCHORAGE:

Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.

Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

Attach to substrates as required to support applied loads.

DEMOLITION:

Disconnect, demolish, and remove Work specified in Division 22 Sections.

If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches (50 mm) beyond face of adjacent construction. Cap and patch surface to match existing finish.

Removal: Remove indicated equipment from Project site.

Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

CUTTING AND PATCHING:

Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

Repair cut surfaces to match adjacent surfaces.

GROUTING:

Install nonmetallic, non-shrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

Clean surfaces that will come into contact with grout.

Provide forms as required for placement of grout.

Avoid air entrapment during placing of grout.

Place grout, completely filling equipment bases.

Place grout on concrete bases to provide smooth bearing surface for equipment.

Place grout around anchors.

Cure placed grout according to manufacturer's written instructions.

END OF SECTION

22 05 13 COMMON MOTOR FOR PLUMBING EQUIPMENT

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes basic requirements for factory-installed and field-installed motors.

Related Sections include the following:

Division 22 Sections for application of motors and reference to specific motor requirements for motor-driven equipment.

SUBMITTALS:

Product Data: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.

Factory Test Reports: For specified tests.

Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

QUALITY ASSURANCE:

Comply with NFPA 70.

Listing and Labeling: Provide motors specified in this Section that are listed and labeled.

- A. Terms "Listed and Labeled": As defined in the National Electrical Code, Article 100.
- B. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

PART 2 PRODUCTS**BASIC MOTOR REQUIREMENTS:**

Basic requirements apply to mechanical equipment motors, unless otherwise indicated.

Motors 1/2 HP and Larger: Polyphase, unless otherwise noted.

Motors Smaller than 1/2 HP: Single phase.

Frequency Rating: 60 Hz.

Voltage Rating: Determined by voltage of circuit to which motor is connected.

Service Factor: 1.15, unless otherwise indicated.

Capacity and Torque Characteristics: Rated for continuous duty and sufficient to start, accelerate, and operate connected loads at designated speeds, in indicated environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

Enclosure: Open dripproof, unless otherwise indicated.

POLYPHASE MOTORS:

Description: NEMA MG 1, medium induction motor.

- A. Design Characteristics: NEMA MG 1, Design B, unless otherwise indicated.
- B. Energy-Efficient Design: High efficiency.
- C. Starter: Copper windings, unless otherwise indicated. Multispeed motors 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.

Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for indicated controller, with required motor leads brought to motor terminal box to suit control method.

Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

- A. Critical vibration frequencies are not within operating range of controller output.
- B. Temperature Rise: Match rating for Class B insulation.
- C. Insulation: Class H.
- D. Thermal Protection: Where indicated, conform to NEMA MG 1 requirements for thermally protected motors.
- E. Shaft grounding rings.

Source Quality Control: Perform the following routine tests according to NEMA MG 1:

- A. Measurement of winding resistance.
- B. No-load readings of current and speed at rated voltage and frequency.
- C. Locked rotor current at rated frequency.
- D. High-potential test.
- E. Alignment.

SINGLE-PHASE MOTORS:

Type: As indicated or selected by manufacturer from one of the following, to suit starting torque and other requirements of specific motor application.

- A. Permanent-split capacitor.
- B. Split-phase start, capacitor run.
- C. Capacitor start, capacitor run.

Shaded-Pole Motors: Do not use, unless motors are smaller than 1/20 hp.

Thermal Protection: Where indicated or required, internal protection automatically opens power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal protection device automatically resets when motor temperature returns to normal range, unless otherwise indicated.

Bearings: Ball-bearing type for belt-connected motors and other motors with high radial forces on motor shaft. Sealed, pre-lubricated sleeve bearings for other single-phase motors.

PART 3 EXECUTION

ADJUSTING:

Use adjustable motor mounting bases for belt-driven motors.

Align pulleys and install belts.

Tension according to manufacturer's written instructions.

END OF SECTION

22 05 19 METERS AND GAGES FOR PLUMBING PIPING

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes meters and gages for mechanical systems and water meters installed outside the building.

Related Sections include the following:

- A. Division 23 Section "Natural Gas Piping" for gas meters.
- B. Mechanical equipment Sections that specify meters and gages as part of factory-fabricated equipment.

SUBMITTALS:

Product Data: Include scale range, ratings, and calibrated performance curves for each meter, gage, fitting, specialty, and accessory specified. Include schedule indicating manufacturer's number, scale range, fittings, and location for each meter and gage.

Maintenance Data: For meters and gages to include in maintenance manuals specified in Division 1. Include data for the following:

- A. Water meters.

PART 2 PRODUCTS**MANUFACTURERS:**

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Liquid-in-Glass Thermometers:
 - 1. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
 - 2. Ernst Gage Co.
 - 3. Marsh Bellofram.
 - 4. Palmer Instruments, Inc.
 - 5. Terice: H. O. Terice Co.
 - 6. Weksler.
- B. Direct-Mounting, Filled-System Dial Thermometers:
 - 1. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
 - 2. Marsh Bellofram.
 - 3. Terice: H. O. Terice Co.
 - 4. Weksler.
- C. Insertion Dial Thermometers:

1. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
2. Trerice: H. O. Trerice Co.
3. Weiss Instruments, Inc.
4. Weksler.

D. Pressure Gages:

1. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
2. Ernst Gage Co.
3. Marsh Bellofram.
4. Weiss Instruments, Inc.
5. Weksler.

E. Test Plugs:

1. Peterson Equipment Co., Inc.
2. Trerice: H. O. Trerice Co.
3. Watts Industries, Inc.; Water Products Div.

F. Wafer-Orifice-Type Flow Elements:

1. ABB, Inc.; ABB Instrumentation.
2. Armstrong Pumps, Inc.
3. Badger Meter, Inc.; Industrial Div. (Tulsa, OK).

G. Flow Indicators:

1. Dwyer Instruments, Inc.
2. Ernst Gage Co.
3. Eugene Ernst Products Co.

H. Water Meters:

1. ABB Water Meters, Inc.
2. Badger Meter, Inc.; Industrial Div. (Milwaukee, WI).
3. Carlon Meter Co., Inc.
4. Hersey Measurement Co.
5. Sensus Technologies, Inc.

THERMOMETERS, GENERAL:

Scale Range: Temperature ranges for services listed are as follows:

- A. Domestic Hot Water: 30 to 240 deg F, with 2-degree scale divisions (0 to 115 deg C, with 1-degree scale divisions).
- B. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions (minus 18 to plus 38 deg C, with 1-degree scale divisions).
- C. Hot Water: 30 to 300 deg F, with 2-degree scale divisions (0 to 150 deg C, with 1-degree scale divisions).

Accuracy: Plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.

LIQUID-IN-GLASS THERMOMETERS:

Description: ASTM E 1.

Case: Die cast and aluminum finished in baked-epoxy enamel, glass front, spring secured, 9 inches (230 mm) long.

Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.

Tube: Red or blue reading, organic-liquid filled with magnifying lens.

Scale: Satin-faced nonreflective aluminum with permanently etched markings.

Stem: Copper-plated steel, aluminum, or brass for separable socket; of length to suit installation.

DIRECT-MOUNTING, FILLED-SYSTEM DIAL THERMOMETERS:

Description: Vapor-actuated, universal-angle dial type.

Case: Drawn steel or cast aluminum, with 4-1/2-inch- (115-mm-) diameter, glass lens.

Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.

Thermal Bulb: Copper with phosphor-bronze bourdon pressure tube.

Movement: Brass, precision geared.

Scale: Progressive, satin-faced nonreflective aluminum with permanently etched markings.

Stem: Copper-plated steel, aluminum, or brass for separable socket; of length to suit installation.

INSERTION DIAL THERMOMETERS:

Description: ASME B40.3, bimetal type.

Dial: 1-inch (25-mm) diameter.

Case: Stainless steel.

Stem: Dustproof and leakproof 1/8-inch- (3-mm-) diameter, tapered-end stem with nominal length of 5 inches (125 mm).

SEPARABLE SOCKETS:

Description: Fitting with protective socket for installation in threaded pipe fitting to hold fixed thermometer stem.

- A. Material: Brass, for use in copper piping.
- B. Material: Steel, for use in steel piping.
- C. Extension-Neck Length: Nominal thickness of 2 inches (50 mm), but not less than thickness of insulation. Omit extension neck for sockets for piping not insulated.
- D. Insertion Length: To extend to center of pipe.
- E. Heat-Transfer Fluid: Oil or graphite.

THERMOMETER WELLS:

Description: Fitting with protective well for installation in threaded pipe fitting to hold test thermometer.

- A. Material: Brass, for use in copper piping.

- B. Material: Steel, for use in steel piping.
- C. Extension-Neck Length: Nominal thickness of 2 inches (50 mm), but not less than thickness of insulation. Omit extension neck for wells for piping not insulated.
- D. Insertion Length: To extend to center of pipe.
- E. Heat-Transfer Fluid: Oil or graphite.

PRESSURE GAGES:

Description: ASME B40.1, phosphor-bronze bourdon-tube type with bottom connection; dry type, unless liquid-filled-case type is indicated.

Case: Drawn steel, brass, or aluminum with 4-1/2-inch- (115-mm-) diameter, glass lens.

Connector: Brass, NPS 1/4 (DN8).

Scale: White-coated aluminum with permanently etched markings.

Accuracy: Grade A, plus or minus 1 percent of middle 50 percent of scale.

Range: Comply with the following:

- A. Vacuum: 30 inches Hg of vacuum to 15 psig of pressure (100 kPa of vacuum to 103 kPa of pressure).
- B. Fluids under Pressure: Two times the operating pressure.

PRESSURE-GAGE FITTINGS:

Valves: NPS 1/4 (DN8) brass or stainless-steel needle type.

Syphons: NPS 1/4 (DN8) coil of brass tubing with threaded ends.

Snubbers: ASME B40.5, NPS 1/4 (DN8) brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.

TEST PLUGS:

Description: Nickel-plated, brass-body test plug in NPS 1/2 (DN15) fitting.

Body: Length as required to extend beyond insulation.

Pressure Rating: 500 psig (3450 kPa) minimum.

Core Inserts: Two self-sealing valves, suitable for inserting 1/8-inch (3-mm) OD probe from dial-type thermometer or pressure gage.

Core Material for Air, Water, Oil, and Gas: 20 to 200 deg F (Minus 7 to plus 93 deg C), chlorosulfonated polyethylene synthetic rubber.

Test-Plug Cap: Gasketed and threaded cap, with retention chain or strap.

FLOW-MEASURING SYSTEMS:

System includes calibrated flow element, separate meter, hoses or tubing, valves, fittings, and conversion chart compatible with flow element, meter, and system fluid.

- A. Flow range of flow-measuring element and meter covers operating range of equipment or system where used.
- B. Display: Visual instantaneous rate of flow.

Permanent Meters: Suitable for wall or bracket mounting. Include 6-inch- (150-mm-) diameter, or equivalent, dial with fittings and copper tubing for connecting to flow element.

- A. Scale: Gallons per minute (Liters per second).
- B. Accuracy: Plus or minus 1 percent of center 60 percent of range.

Include complete operating instructions with each meter.

FLOW INDICATORS:

Description: Instrument for visual verification of flow; made for installation in piping systems.

- A. Construction: Bronze or stainless-steel body, with sight glass and plastic pelton-wheel indicator.
- B. Pressure Rating: 125 psig (860 kPa).
- C. Temperature Rating: 200 deg F (93 deg C).

WATER METERS:

Contractor to purchase and install meter from local utility or to purchase meter as required by local utility.

Description: NPS 2" and smaller, AWWA C701, turbine type. Registers flow in gallons (liters) or cubic feet (cubic meters) as required by utility.

Description: NPS 3" and larger, AWWA C702, compound type, bronze case. Registers flow in gallons (liters) or cubic feet (cubic meters) as required by utility.

Description: AWWA C703, UL-listed, FM-approved, main-line, proportional, detector type; 150-psig (1035-kPa) working pressure; with meter on bypass. Registers flow in gallons (liters) or cubic feet (cubic meters) as required by utility.

- A. Bypass Meter: AWWA C702, compound type, bronze case; size not less than one-half nominal size of main-line meter.
- B. Bypass Meter: AWWA C701, turbine type, bronze case; size not less than one-half nominal size of main-line meter.

Description: AWWA C703, UL-listed, FM-approved, main-line-turbine, detector type; 175-psig (1200-kPa) working pressure; with strainer and with meter on bypass. Registers flow in gallons (liters) or cubic feet (cubic meters) as required by utility.

Bypass Meter: AWWA C701, turbine type, bronze case; not less than NPS 2 (DN50).

PART 3 EXECUTION

METER AND GAGE INSTALLATION, GENERAL:

Install meters, gages, and accessories according to manufacturer's written instructions for applications where used.

THERMOMETER INSTALLATION:

Install thermometers and adjust vertical and tilted positions.

Install in the following locations:

- A. Inlet and outlet of each hydronic boiler.
- B. Inlet and outlet of each thermal storage tank.

Install thermometer wells in vertical position in piping tees where test thermometers are indicated.

- A. Install with stem extending to center of pipe.
- B. Fill wells with oil or graphite and secure caps.

PRESSURE-GAGE INSTALLATION:

Install pressure gages in piping tees with pressure-gage valve located on pipe at most readable position.

Install dry-type pressure gages in the following locations:

- A. Discharge of each pressure-reducing valve.
- B. Building water-service entrance.

Install liquid-filled-type pressure gages at suction and discharge of each pump.

Install pressure-gage needle valve and snubber in piping to pressure gages.

Exception: Install syphon instead of snubber in piping to steam pressure gages.

FLOW-MEASURING SYSTEM INSTALLATION:

Install flowmeters in accessible and most readable positions in piping systems.

Install flow-measuring elements and meters at discharge of each pump, at inlet of each hydronic coil in built-up central systems, and elsewhere as indicated.

Install wafer-orifice-type flow elements between two pipe flanges.

Install connection fittings for attachment to portable flowmeters in accessible locations.

Install permanently mounted meters for flow elements on walls or brackets in accessible locations.

Install connections, tubing, and accessories between flow elements and meters as prescribed by manufacturer's written instructions.

WATER METER INSTALLATION:

Install water meters, piping, and specialties according to AWWA M6 and utility's requirements.

- A. Install displacement-type water meters with shutoff valve on water meter inlet. Install valve on water meter outlet and valved bypass around meter, unless prohibited by authorities having jurisdiction.

- B. Install compound-type water meters with shutoff valves on water meter inlet and outlet and on valved bypass around meter. Support meters, valves, and piping on brick or concrete piers.

ROUGHING-IN FOR WATER METERS:

Install roughing-in piping and specialties for water meter installation according to utility's instructions and requirements.

CONNECTIONS:

Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties. The following are specific connection requirements:

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance.
- B. Connect flow-measuring-system elements to meters.
- C. Connect flowmeter transmitters to meters.

Electrical Contractor to make connections to power supply and electrically operated meters and devices.

Ground electrically operated meters.

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.

Install electrical connections for power and devices.

Electrical power, wiring, and connections are specified in Division 26 Sections.

ADJUSTING AND CLEANING:

Calibrate meters according to manufacturer's written instructions, after installation.

Adjust faces of meters and gages to proper angle for best visibility.

Clean windows of meters and gages and clean factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touchup paint.

END OF SECTION

22 05 23 GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes general duty valves common to several mechanical piping systems.

Related Sections: The following Sections contain requirements that relate to this Section:

- A. Special purpose valves are specified in Division 22 piping system Sections.
- B. Valve tags and charts are specified in Division 22 Section "Mechanical Identification."

SUBMITTALS:

General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

Product Data for each valve type. Include body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions. Include list indicating valve and its application.

Maintenance data for valves to include in the operation and maintenance manual specified in Division 1. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

QUALITY ASSURANCE:

Single-Source Responsibility: Comply with the requirements specified in Division 1 Section "Materials and Equipment," under "Source Limitations" Paragraph.

ASME Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.

MSS Compliance: Comply with the various MSS Standard Practice documents referenced.

DELIVERY, STORAGE, AND HANDLING:

Prepare valves for shipping as follows:

- A. Protect internal parts against rust and corrosion.
- B. Protect threads, flange faces, grooves, and weld ends.
- C. Set globe valves closed to prevent rattling.
- D. Set ball and plug valves open to minimize exposure of functional surfaces.
- E. Set butterfly valves closed or slightly open.
- F. Block check valves in either closed or open position.

Use the following precautions during storage:

- A. Maintain valve end protection.
- B. Store indoors and maintain valve temperature higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

Use a sling to handle large valves. Rig to avoid damage to exposed parts. Do not use handwheels and stems as lifting or rigging points.

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Ball Valves:
 - 1. Hammond Valve Corporation.
 - 2. Milwaukee Valve Company, Inc.
 - 3. NIBCO Inc.
 - 4. Stockham Valves & Fittings, Inc.
 - 5. Victaulic Company of America.
 - 6. Apollo.
- B. Plug Valves:
 - 1. NIBCO Inc.
 - 2. Stockham Valves & Fittings, Inc.
 - 3. Victaulic Company of America.
- C. Globe Valves:
 - 1. Hammond Valve Corporation.
 - 2. Milwaukee Valve Company, Inc.
 - 3. NIBCO Inc.
 - 4. Stockham Valves & Fittings, Inc.
- D. Butterfly Valves:
 - 1. Center Line, Mark Controls Corporation.
 - 2. Hammond Valve Corporation.
 - 3. Keystone Valve USA, Inc.
 - 4. Milwaukee Valve Company, Inc.
 - 5. NIBCO Inc.
 - 6. Stockham Valves & Fittings, Inc.
 - 7. Victaulic Company of America.
- E. Swing Check Valves:
 - 1. Hammond Valve Corporation.
 - 2. Milwaukee Valve Company, Inc.
 - 3. NIBCO Inc.
 - 4. Stockham Valves & Fittings, Inc.
 - 5. Victaulic Company of America.

BASIC, COMMON FEATURES:

Design: Rising stem or rising outside screw and yoke stems, except as specified below.

Non-rising stem valves may be used only where headroom prevents full extension of rising stems.

Pressure and Temperature Ratings: As indicated in the "Application Schedule" of Part 3 of this Section and as required to suit system pressures and temperatures.

Sizes: Same size as upstream pipe, unless otherwise indicated.

Operators: Use specified operators and handwheels, except provide the following special operator features:

- A. Handwheels: For valves other than quarter turn.
- B. Lever Handles: For quarter-turn valves 6 inches (DN150) and smaller, except for plug valves, which shall have square heads. Furnish Owner with 1 wrench for every 10 plug valves.
- C. Chain-Wheel Operators: For valves 4 inches (DN100) and larger, installed 84 inches (2400 mm) or higher above finished floor elevation.
- D. Gear-Drive Operators: For quarter-turn valves 8 inches (DN200) and larger.

Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.

Bypass and Drain Connections: Comply with MSS SP-45 bypass and drain connections.

Threads: ASME B1.20.1.

Flanges: ASME B16.1 for cast iron, ASME B16.5 for steel, and ASME B16.24 for bronze valves.

Solder Joint: ASME B16.18.

Caution: Where soldered end connections are used, use solder having a melting point below 840 deg F (450 deg C) for gate, globe, and check valves; below 421 deg F (216 deg C) for ball valves.

BALL VALVES:

Ball Valves, 4 Inches (DN100) and Smaller: MSS SP-110, Class 150, 600-psi (4140-kPa) CWP, ASTM B 584 bronze body and bonnet, 2-piece construction; chrome-plated brass ball, standard port for 1/2-inch (DN15) valves and smaller and full port for 3/4-inch (DN20) valves and larger; blowout proof; bronze or brass stem; teflon seats and seals; threaded or soldered end connections:

Operator: Vinyl-covered steel lever handle, unless noted otherwise.

PLUG VALVES:

Plug Valves: MSS SP-78, 175-psi (1200-kPa) CWP, ASTM A 126 cast-iron body and bonnet, cast-iron plug, Buna N, Viton, or teflon packing, flanged or grooved end connections:

Operator: Lever.

GLOBE VALVES:

Globe Valves, 2-1/2 Inches (DN65) and Smaller: MSS SP-80; Class 125, 200-psi (1380-kPa) CWP, or Class 150, 300-psi (2070-kPa) CWP; ASTM B 62 cast-bronze body and screwed bonnet, rubber,

bronze, or teflon disc, silicon bronze-alloy stem, teflon-impregnated packing with bronze nut, threaded or soldered end connections; and with aluminum or malleable-iron handwheel.

Globe Valves, 3 Inches (DN80) and Larger: MSS SP-85, Class 125, 200-psi (1380-kPa) CWP, ASTM A 126 cast-iron body and bolted bonnet with bronze fittings, renewable bronze seat and disc, brass-alloy stem, outside screw and yoke, teflon-impregnated packing with cast-iron follower, flanged end connections; and with cast-iron handwheel.

BUTTERFLY VALVES:

Butterfly Valves: MSS SP-67, 200-psi (1380-kPa) CWP, 150-psi (1035- kPa) maximum pressure differential, ASTM A 126 cast-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals, wafer, lug, or grooved style:

Disc Type: Aluminum bronze.

Operator for Sizes 2 Inches (DN50) to 6 Inches (DN150): Standard lever handle with memory stop.

Operator for Sizes 8 Inches (DN200) to 24 Inches (DN600): Gear operator with position indicator and chain wheel if operator is higher than 84" above floor.

CHECK VALVES:

Swing Check Valves, 2-1/2 Inches (DN65) and Smaller: MSS SP-80; Class 125, 200-psi (1380-kPa) CWP, or Class 150, 300-psi (2070-kPa) CWP; horizontal swing, Y-pattern, ASTM B 62 cast-bronze body and cap, rotating bronze disc with rubber seat or composition seat, threaded or soldered end connections, non-slam.

Swing Check Valves, 3 Inches (DN80) and Larger: MSS SP-71, Class 125, 200-psi (1380-kPa) CWP, ASTM A 126 cast-iron body and bolted cap, horizontal-swing bronze disc, flanged or grooved end connections, non-slam.

PART 3 EXECUTION

EXAMINATION:

Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.

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.

Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.

Examine threads on valve and mating pipe for form and cleanliness.

Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.

Do not attempt to repair defective valves; replace with new valves.

INSTALLATION:

Install valves as indicated, according to manufacturer's written instructions.

Piping installation requirements are specified in other Division 22 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.

Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.

Locate valves for easy access and provide separate support where necessary.

Install valves in horizontal piping with stem at or above the center of the pipe.

Install valves in a position to allow full stem movement.

For chain-wheel operators, extend chains to 60 inches (1500 mm) above finished floor elevation.

Install check valves for proper direction of flow as follows in a horizontal or vertical position with hinge pin level.

SOLDERED CONNECTIONS:

Cut tube square and to exact lengths.

Clean end of tube to depth of valve socket with steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket.

Apply proper soldering flux in an even coat to inside of valve socket and outside of tube.

Open globe valves to fully open position.

Remove the cap and disc holder of swing check valves having composition discs.

Insert tube into valve socket, making sure the end rests against the shoulder inside valve. Rotate tube or valve slightly to ensure even distribution of the flux.

Apply heat evenly to outside of valve around joint until solder melts on contact. Feed solder until it completely fills the joint around tube. Avoid hot spots or overheating valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush.

THREADED CONNECTIONS:

Note the internal length of threads in valve ends and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve.

Align threads at point of assembly.

Apply appropriate tape or thread compound to the external pipe threads, except where dry seal threading is specified.

Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

FLANGED CONNECTIONS:

Align flange surfaces parallel.

Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

For dead-end service, butterfly valves require flanges both upstream and downstream for proper shutoff and retention.

VALVE END SELECTION:

Select valves with the following ends or types of pipe/tube connections:

- A. Copper Tube Size, 2-1/2 Inches (DN65) and Smaller: Solder ends, except provide threaded ends for heating hot water and low-pressure steam service.
- B. Steel Pipe Sizes, 2 Inches (DN65) and Smaller: Threaded or grooved end.
- C. Steel Pipe Sizes, 2-1/2 Inches (DN80) and Larger: Grooved end or flanged.

APPLICATION SCHEDULE:

General Application: Use ball and butterfly valves for shutoff duty; globe, ball, and butterfly for throttling duty. Refer to piping system Specification Sections for specific valve applications and arrangements.

- A. Domestic Water Systems: Use the following valve types:
 - 1. Ball Valves: Class 150, 600-psi (4140-kPa) CWP, with stem extension.
 - 2. Globe Valves: Class 125, bronze or cast-iron body to suit piping system, and bronze or teflon disc.
 - 3. Butterfly Valves: Nickel-plated ductile iron, aluminum bronze, or elastomer-coated ductile iron disc; EPDM or Buna N sleeve and stem seals.
 - 4. Bronze Swing Check: Class 125, with rubber seat.

ADJUSTING:

Adjust or replace packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves if leak persists.

END OF SECTION

22 05 29 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes hangers and supports for mechanical system piping and equipment.

Related Sections include the following:

- A. Division 5 Section "Metal Fabrications" for materials for attaching hangers and supports to building structure.
- B. Division 21 Sections on fire-suppression piping for fire-suppression pipe hangers.
- C. Division 22 Section "Mechanical Vibration Controls and Seismic Restraints" for vibration isolation and seismic restraint devices.

DEFINITIONS:

MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

PERFORMANCE REQUIREMENTS:

Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

SUBMITTALS:

Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.

Welding Certificates: Copies of certificates for welding procedures and operators.

QUALITY ASSURANCE:

Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and trapeze by a qualified professional engineer.

Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, and seismic restraint by a qualified professional engineer.

- A. 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 hangers and supports that are similar to those indicated for this Project in material, design, and extent.

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Pipe Hangers:
1. AAA Technology and Specialties Co., Inc.
 2. B-Line Systems, Inc.
 3. Erico.
 4. Globe Pipe Hanger Products, Inc.
 5. Grinnell Corp.
 6. GS Metals Corp.
 7. National Pipe Hanger Corp.
 8. PHD Manufacturing, Inc.
 9. PHS Industries, Inc.
 10. Piping Technology & Products, Inc.
- B. Channel Support Systems:
1. B-Line Systems, Inc.
 2. Erico.
 3. Grinnell Corp.; Power-Strut Unit.
 4. GS Metals Corp.
 5. National Pipe Hanger Corp.
 6. Thomas & Betts Corp.
 7. Unistrut Corp.
- C. Thermal-Hanger Shield Inserts:
1. PHS Industries, Inc.
 2. Pipe Shields, Inc.
 3. Rilco Manufacturing Co., Inc.
 4. Value Engineered Products, Inc.
- D. Powder-Actuated Fastener Systems:
1. Gunnebo Fastening Corp.
 2. Hilti, Inc.
 3. ITW Ramset/Red Head.
 4. Masterset Fastening Systems, Inc.

MANUFACTURED UNITS:

Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support

types.

- A. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
- B. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

- A. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- B. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive-strength insulation, encased in sheet metal shield.

- A. Material for Piping: ASTM C 552, Type I cellular glass or high density polyisocyanurate insulation.
- B. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
- C. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
- D. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield.

MISCELLANEOUS MATERIALS:

Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, non-shrink and nonmetallic, dry, hydraulic-cement grout.

- A. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
- B. Properties: Non-staining, noncorrosive, and nongaseous.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 EXECUTION

HANGER AND SUPPORT APPLICATIONS:

Specific hanger requirements are specified in Sections specifying equipment and systems.

Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

- A. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated

stationary pipes, NPS 1/2 to NPS 30 (DN15 to DN750).

- B. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN100 to DN900), with steel pipe base stanchion support and cast-iron floor flange.
- C. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN65 to DN900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
- D. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN25 to DN750), from two rods if longitudinal movement caused by expansion and contraction might occur.
- E. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN65 to DN500), from single rod if horizontal movement caused by expansion and contraction might occur.
- F. Roof Pillow Block Pipe Stands: Adjustable height roller bearing pipe support. Self-lubricated polycarbonate roller polycarbonate resin rod. Pipe support base of polycarbonate or stainless steel.

Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

- A. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500).
- B. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500), if longer ends are required for riser clamps.

Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

- A. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
- B. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- C. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
- D. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
- E. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

- A. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
- B. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
- C. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
- D. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
- E. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
- F. C-Clamps (MSS Type 23): For structural shapes.
- G. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
- H. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
- I. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
- J. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams

for heavy loads, with link extensions.

- K. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
- L. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - 1. Light (MSS Type 31): 750 lb (340 kg).
 - 2. Medium (MSS Type 32): 1500 lb (675 kg).
 - 3. Heavy (MSS Type 33): 3000 lb (1350 kg).
- M. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- N. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- O. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where head room is limited.

Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

- A. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
- B. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
- C. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi (690-kPa) minimum compressive-strength, high density polyisocyanurate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

HANGER AND SUPPORT INSTALLATION:

Pipe Hanger and Support 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.

Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.

- A. Field assemble and install according to manufacturer's written instructions.

Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.

- A. 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.
- B. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, 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.

Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

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.

Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

Insulated Piping: Comply with the following:

- A. Attach clamps and spacers to piping.
 - 1. Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - 2. Do not exceed pipe stress limits according to ASME B31.9.
- B. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - 1. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
- C. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.
 - 1. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
- D. Shield Dimensions for Pipe: Not less than the following:
 - 1. NPS 1/4 to NPS 3-1/2 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - 2. NPS 4 (DN100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - 3. NPS 5 and NPS 6 (DN125 and DN150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
 - 4. NPS 8 to NPS 14 (DN200 to DN350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
 - 5. NPS 16 to NPS 24 (DN400 to DN600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
- E. Insert Material: Length at least as long as protective shield.
- F. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

EQUIPMENT SUPPORTS:

Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

Grouting: Place grout under supports for equipment and make smooth bearing surface.

METAL FABRICATION:

Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

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:

- A. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
- B. Obtain fusion without undercut or overlap.
- C. Remove welding flux immediately.
- D. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

ADJUSTING:

Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

PAINTING:

Touching 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.

- A. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 Section "Painting."

Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

22 05 53 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes mechanical identification materials and devices.

SUBMITTALS:

Product Data: For identification materials and devices.

Samples: Of color, lettering style, and graphic representation required for each identification material and device.

Valve Schedules: For each piping system. Reproduce on standard-size bond paper. Tabulate valve number, piping system, system abbreviation as shown on tag, room or space location of valve, and variations for identification. Mark valves intended for emergency shutoff and similar special uses. Besides mounted copies, furnish copies for maintenance manuals specified in Division 1.

QUALITY ASSURANCE:

Comply with ASME A13.1, "Scheme for the Identification of Piping Systems" for lettering size, length of color field, colors, and viewing angles of identification devices.

SEQUENCING AND SCHEDULING:

Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS**IDENTIFYING DEVICES AND LABELS:**

General: Products specified are for applications referenced in other Division 22 Sections. If more than single type is specified for listed applications, selection is Installer's option.

Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

- A. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
- B. Location: Accessible and visible.

Snap-On Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers, extending 360 degrees around pipe at each location.

Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers, at least 3 times letter height and of length required for label.

Lettering: Manufacturer's standard preprinted captions as selected by Architect.

Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

- A. Arrows: Either integrally with piping system service lettering, to accommodate both directions, or as separate unit, on each pipe marker to indicate direction of flow.

Valve Tags: Stamped or engraved with 1/4-inch (6-mm) letters for piping system abbreviation and 1/2-inch (13-mm) sequenced numbers. Include 5/32-inch (4-mm) hole for fastener.

- A. Material: 0.032-inch- (0.8-mm-) thick, polished brass.
- B. Size: 1-1/2-inches (40-mm) diameter, unless otherwise indicated.
- C. Shape: Round.

Valve Tag Fasteners: Brass, wire-link chain; beaded chain; or S-hooks.

Access Panel Markers: 1/16-inch- (2-mm-) thick, engraved plastic-laminate markers, with abbreviated terms and numbers corresponding to concealed valve. Provide 1/8-inch (3-mm) center hole for attachment.

Valve Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include screws.

- A. Frame: Finished hardwood.
- B. Frame: Extruded aluminum.
- C. Glazing: ASTM C 1036, Type I, Class 1, Glazing quality B, 2.5-mm, single-thickness glass.

Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

- A. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
- B. Thickness: 1/8 inch (3 mm), unless otherwise indicated.
- C. Thickness: 1/16 inch (2 mm), for units up to 20 sq. in. (130 sq. cm) or 8 inches (200 mm) in length, and 1/8 inch (3 mm) for larger units.
- D. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

- A. Green: Cooling equipment and components.
- B. Yellow: Heating equipment and components.
- C. Brown: Energy reclamation equipment and components.
- D. Blue: Equipment and components that do not meet criteria above.
- E. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.

- F. Terminology: Match schedules as closely as possible. Include the following:
1. Name and plan number.
 2. Equipment service.
 3. Design capacity.
 4. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
- G. Size: 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.

Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.

- A. Size: 3-1/4 by 5-5/8 inches (85 by 145 mm).
- B. Fasteners: Brass grommets and wire.
- C. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of mechanical systems and equipment.

- A. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

PART 3 EXECUTION

LABELING AND IDENTIFYING PIPING SYSTEMS:

Install pipe markers on each system. Include arrows showing normal direction of flow.

Marker Type: Plastic markers, with application systems. Install on pipe insulation segment where required for hot, non-insulated pipes.

Fasten markers on pipes and insulated pipes smaller than 6 inches (150 mm) OD by one of following methods:

- A. Snap-on application of pretensioned, semirigid plastic pipe marker.

Fasten markers on pipes and insulated pipes 6 inches (150 mm) in diameter and larger by one of following methods:

- A. Strapped to pipe or insulation with manufacturer's standard stainless-steel bands.

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 according to the following:

- A. Near each valve and control device.
- B. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
- C. Near penetrations through walls, floors, ceilings, or non-accessible enclosures.
- D. At access doors, manholes, and similar access points that permit view of concealed piping.

- E. Near major equipment items and other points of origination and termination.
- F. Spaced at a maximum of 50-foot (15-m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in areas of congested piping and equipment.
- G. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

VALVE TAGS:

Install on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, plumbing fixture supply stops, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in valve schedule.

Valve Tag Application Schedule: Tag valves according to size, shape, color scheme, and with captions similar to those indicated in the following:

Tag Material: Brass.

Tag Size and Shape: 1-1/2 inches (40 mm), round.

Install mounted valve schedule in each major equipment room.

EQUIPMENT SIGNS AND MARKERS:

Install engraved plastic-laminate signs or equipment markers on or near each major item of mechanical equipment. Include signs for the following general categories of equipment:

- A. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
- B. Fire department hose valves and hose stations.
- C. Meters, gages, thermometers, and similar units.
- D. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
- E. Pumps, compressors, chillers, condensers, and similar motor-driven units.
- F. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
- G. Tanks and pressure vessels.
- H. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

ADJUSTING AND CLEANING:

Relocate mechanical identification materials and devices that have become visually blocked by work of this or other Divisions.

Clean faces of identification devices and glass frames of valve charts.

END OF SECTION

22 07 19 PLUMBING PIPING INSULATION

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

Related Sections include the following:

- A. Division 7 Section "Firestopping" for firestopping materials and requirements for penetrations through fire and smoke barriers.
- B. Division 22 Section "Equipment Insulation" for insulation materials and application for pumps, tanks, hydronic specialties, and other equipment.
- C. Division 22 Section "Hangers and Supports" for pipe insulation shields and protection saddles.

SUBMITTALS:

Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

Shop Drawings: Show fabrication and installation details for the following:

- A. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
- B. Attachment and covering of heat trace inside insulation.
- C. Insulation application at pipe expansion joints for each type of insulation.
- D. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
- E. Removable insulation at piping specialties and equipment connections.
- F. Application of field-applied jackets.

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.

Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

QUALITY ASSURANCE:

Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

- A. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
- B. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

DELIVERY, STORAGE, AND HANDLING:

Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

COORDINATION:

Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports."

Coordinate clearance requirements with piping Installer for insulation application.

Coordinate installation and testing of electric heat tracing.

SCHEDULING:

Schedule insulation application after testing piping systems and, where required, after installing and testing heat-trace tape. Insulation application may begin on segments of piping that have satisfactory test results.

PART 2 PRODUCTS**MANUFACTURERS:**

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Mineral-Fiber Insulation:
 - 1. CertainTeed Manson.
 - 2. Knauf FiberGlass GmbH.
 - 3. Owens-Corning Fiberglas Corp.
 - 4. John Manville.
- B. Flexible Elastomeric Thermal Insulation:
 - 1. Armstrong World Industries, Inc.
 - 2. Rubatex Corp.
- C. Polyolefin Insulation:
 - 1. Armstrong World Industries, Inc.
 - 2. IMCOA.

INSULATION MATERIALS:

Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:

- A. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.
- B. Blanket Insulation: Comply with ASTM C 553, Type II, without facing.

- C. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:
 - 1. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
 - 2. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.
- D. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
- E. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
- F. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.
- G. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

- A. Adhesive: As recommended by insulation material manufacturer.
- B. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

Polyolefin Insulation: Unicellular polyethylene thermal plastic, preformed pipe insulation. Comply with ASTM C 534, Type I, except for density.

- A. Adhesive: As recommended by insulation material manufacturer.

Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

FIELD-APPLIED JACKETS:

General: ASTM C 921, Type 1, unless otherwise indicated.

Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming.

- A. Adhesive: As recommended by insulation material manufacturer.
- B. PVC Jacket Color: White or gray.
- C. PVC Jacket Color: Color-code piping jackets based on materials contained within the piping system.

Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil- (0.5-mm) thick, high-impact, ultraviolet-resistant PVC.

- A. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
- B. Adhesive: As recommended by insulation material manufacturer.

Aluminum Jacket: Factory cut and rolled to indicated sizes. Comply with ASTM B 209 (ASTM B 209M), 3003 alloy, H-14 temper.

Aluminum Jacket: Aluminum roll stock, ready for shop or field cutting and forming to indicated sizes. Comply with ASTM B 209 (ASTM B 209M), 3003 alloy, H-14 temper.

- A. Finish and Thickness: Stucco-embossed finish, 0.016 inch (0.40 mm) thick.
- B. Moisture Barrier: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.
- C. Elbows: Preformed, 45- and 90-degree, short- and long-radius elbows; same material, finish, and thickness as jacket.

ACCESSORIES AND ATTACHMENTS:

Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).

- A. Tape Width: 4 inches (100 mm).

Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:

- A. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.
- B. Galvanized Steel: 0.005 inch (0.13 mm) thick.
- C. Aluminum: 0.007 inch (0.18 mm) thick.

Wire: 0.080-inch (2.0-mm), nickel-copper alloy; 0.062-inch (1.6-mm), soft-annealed, stainless steel; or 0.062-inch (1.6-mm), soft-annealed, galvanized steel.

VAPOR RETARDERS:

Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 EXECUTION

EXAMINATION:

Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

Proceed with installation only after unsatisfactory conditions have been corrected.

PREPARATION:

Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

GENERAL APPLICATION REQUIREMENTS:

Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.

Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

Apply multiple layers of insulation with longitudinal and end seams staggered.

Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

Keep insulation materials dry during application and finishing.

Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

Apply insulation with the least number of joints practical.

Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

- A. Apply insulation continuously through hangers and around anchor attachments.
- B. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- C. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
- D. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

Apply adhesives and mastics at the manufacturer's recommended coverage rate.

Apply insulation with integral jackets as follows:

- A. Pull jacket tight and smooth.
- B. Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.
- C. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply 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 (100 mm) o.c.
 1. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
- D. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
- E. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

- A. Seal penetrations with vapor-retarder mastic.
- B. Apply insulation for exterior applications tightly joined to interior insulation ends.
- C. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
- D. Seal metal jacket to roof flashing with vapor-retarder mastic.

Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.

Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.

- A. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Firestopping."

Floor Penetrations: Apply insulation continuously through floor assembly.

- A. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

MINERAL-FIBER INSULATION APPLICATION:

Apply insulation to straight pipes and tubes as follows:

- A. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
- B. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet (4.5 to 6 m) to form a vapor retarder between pipe insulation segments.
- C. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
- D. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

Apply insulation to flanges as follows:

- A. Apply preformed pipe insulation to outer diameter of pipe flange.
- B. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
- C. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
- D. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

Apply insulation to fittings and elbows as follows:

- A. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
- B. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.

- C. Cover fittings with standard PVC fitting covers.
- D. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch (25 mm) at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

Apply insulation to valves and specialties as follows:

- A. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
- B. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
- C. Apply insulation to flanges as specified for flange insulation application.
- D. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
- E. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
- F. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION:

Apply insulation to straight pipes and tubes as follows:

- A. Follow manufacturer's written instructions for applying insulation.
- B. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

Apply insulation to flanges as follows:

- A. Apply pipe insulation to outer diameter of pipe flange.
- B. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
- C. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of the same thickness as pipe insulation.
- D. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

Apply insulation to fittings and elbows as follows:

- A. Apply mitered sections of pipe insulation.
- B. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

Apply insulation to valves and specialties as follows:

- A. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
- B. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to strainer basket.

- C. Apply insulation to flanges as specified for flange insulation application.
- D. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

POLYOLEFIN INSULATION APPLICATION:

Apply insulation to straight pipes and tubes as follows:

- A. Follow manufacturer's written instructions for applying insulation.
- B. For split tubes, seal longitudinal seams and end joints with manufacturer's recommended adhesive.
- C. For self-adhesive insulation, staple longitudinal seams after sealing. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

Apply insulation to flanges as follows:

- A. Apply pipe insulation to outer diameter of pipe flange.
- B. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
- C. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of the same thickness as pipe insulation.
- D. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

Apply insulation to fittings and elbows as follows:

- A. Apply mitered sections of polyolefin pipe insulation.
- B. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

Apply insulation to valves and specialties as follows:

- A. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
- B. Apply cut segments of polyolefin pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to stainer basket.
- C. Apply insulation to flanges as specified for flange insulation application.
- D. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

FIELD-APPLIED JACKET APPLICATION:

Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

- A. Apply jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
- B. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of jacket manufacturer's recommended adhesive.
- C. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

Foil and Paper Jackets: Apply foil and paper jackets where indicated.

- A. Draw jacket material smooth and tight.
- B. Apply lap or joint strips with the same material as jacket.
- C. Secure jacket to insulation with manufacturer's recommended adhesive.
- D. Apply jackets with 1-1/2-inch (40-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
- E. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.

Apply PVC jacket on exposed piping in finished spaces, with 1-inch (25-mm) overlap at longitudinal seams and end joints, except for mechanical rooms. Seal with manufacturer's recommended adhesive.

Apply metal jacket where indicated, with 2-inch (50-mm) 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 (300 mm) o.c. and at end joints.

FINISHES:

Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Division 9 Section "Painting."

Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of the insulation manufacturer's recommended protective coating.

Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

PIPING SYSTEM APPLICATIONS:

Insulation materials and thicknesses are specified in schedules at the end of this Section.

Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

- A. Flexible connectors.
- B. Vibration-control devices.
- C. Fire-suppression piping.
- D. Drainage piping located in crawl spaces, unless otherwise indicated.
- E. Below-grade piping, unless otherwise indicated.
- F. Chrome-plated pipes and fittings, unless potential for personnel injury.
- G. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

FIELD QUALITY CONTROL:

Insulation applications will be considered defective if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.

Reinstall insulation and covers on fittings and valves uncovered for inspection according to these Specifications.

INSULATION APPLICATION SCHEDULE, GENERAL:

Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.

Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

INTERIOR INSULATION APPLICATION SCHEDULE:

Service: Domestic cold (potable and non-potable), hot and re-circulated hot water.

- A. Operating Temperature: 60 to 140 deg F (15 to 60 deg C).
- B. Insulation Material: Mineral fiber.
- C. Insulation Thickness: 1 inch.
- D. Field-Applied Jacket: PVC in exposed finished rooms up to 12 feet above finished floor.
- E. Vapor Retarder Required: Yes.
- F. Finish: None.

Service: Domestic cold (potable and non-potable) and hot water in block walls.

- A. Operating Temperature: 60 to 140 deg F (15 to 60 deg C).
- B. Insulation Material: Flexible elastomeric.
- C. Insulation Thickness: $\frac{3}{4}$ inch.
- A. Field-Applied Jacket: PVC in exposed finished rooms up to 12 feet above finished floor.
- D. Vapor Retarder Required: Yes.
- E. Finish: Painted.

Service: Rainwater conductors and roof drain bodies.

- A. Operating Temperature: 32 to 100 deg F (0 to 38 deg C).
- B. Insulation Material: Mineral fiber.
- C. Insulation Thickness: 1 inch.
- B. Field-Applied Jacket: PVC in exposed finished rooms up to 12 feet above finished floor.
- C. Vapor Retarder Required: Yes.
- D. Finish: None.

Service: Condensate drain piping.

- A. Operating Temperature: 35 to 75 deg F (2 to 24 deg C).
- B. Insulation Material: Mineral fiber.
- C. Insulation Thickness: 1 inch.
- E. Field-Applied Jacket: PVC in exposed finished rooms up to 12 feet above finished floor.
- D. Vapor Retarder Required: Yes.
- E. Finish: None.

END OF SECTION

22 11 16 DOMESTIC WATER PIPING

PART 1 GENERAL**RELATED DOCUMENTS**

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

SUMMARY:

This Section includes water distribution piping from locations indicated to fixtures and equipment inside building.

Related Sections include the following:

- A. Division 33 Section "Water Systems" for exterior water service piping.
- B. Division 22 Section "Meters and Gages" for water meters, thermometers, pressure gages, and fittings.
- C. Division 22 Section "Plumbing Specialties" for water distribution piping specialties.

DEFINITIONS:

Water Service Piping: Water piping outside building that conveys water to building.

Service Entrance Piping: Water piping at entry into building between water service piping and water distribution piping.

Water Distribution Piping: Water piping inside building that conveys water to fixtures and equipment throughout the building.

The following are industry abbreviations for plastic piping materials:

- A. CPVC: Chlorinated polyvinyl chloride.
- B. NP: Nylon.
- C. PB: Polybutylene.
- D. PE: Polyethylene.
- E. PP: Polypropylene.
- F. PVC: Polyvinyl chloride.

SYSTEM PERFORMANCE REQUIREMENTS:

Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

- A. Service Entrance Piping: 160 psig (1100 kPa).
- B. Water Distribution Piping: 125 psig (860 kPa).

SUBMITTALS:

Water Samples, Test Results, and Reports: Specified in "Field Quality Control" and "Cleaning" articles.

Grooved Joint Couplings and Fittings: Shall be shown on drawings and product submittals, and shall be specifically identified with the applicable style or series designation.

QUALITY ASSURANCE:

Provide listing/approval stamp, label, or other marking on piping made to specified standards.

Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic potable-water piping components. Include marking "NSF-pw" on plastic potable-water piping.

Comply with NSF 61, "Drinking Water System Components--Health Effects," Sections 1 through 9 for potable-water piping and components.

All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

- A. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

EXTRA MATERIALS:

Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents. Deliver materials to Owner.

- A. Keyed Couplings, 4-Inch NPS (DN100) and Smaller: 12 of each type and size installed. Include one extra gasket with each extra coupling.

PART 2 PRODUCTS

PIPES AND TUBES:

General: Applications of the following pipe and tube materials are indicated in Part 3 "Piping Applications" Article.

Soft Copper Tube: ASTM B 88, Types K (ASTM B 88M, Type A), water tube, annealed temper.

Hard Copper Tube: ASTM B 88, Types L (ASTM B 88M, Type B), water tube, drawn temper.

Ductile-Iron Pipe: AWWA C151, 250 psig (1725 kPa) minimum pressure rating with mechanical- or push-on-joint bell, plain spigot end, and AWWA C104 cement-mortar lining. Include AWWA C111 ductile-iron gland, rubber gasket, and steel bolts with mechanical-joint pipe. Include AWWA C111 rubber gasket with push-on-joint pipe.

Ductile-Iron Pipe: AWWA C151, 250 psig (1725 kPa) minimum pressure rating with mechanical-joint bell, plain spigot end, and AWWA C104 cement-mortar lining. Include AWWA C111 ductile-iron gland, rubber gasket, and steel bolts.

Ductile-Iron Pipe: AWWA C151, 250 psig (1725 kPa) minimum pressure rating with push-on-joint bell, plain spigot end, and AWWA C104 cement-mortar lining. Include AWWA C111 rubber gasket.

Ductile-Iron Pipe: AWWA C151, Class53 (min), 250 psig (1725 kPa) minimum pressure rating with AWWA C606 grooved ends, and AWWA C104 cement-mortar lining.

PVC Plastic Pipe: ASTM D 1785, Schedules 40 and 80.

PVC Plastic Pipe: AWWA C900, Classes 150 and 200; with bell end with gasket, and spigot end.

PIPE AND TUBE FITTINGS:

General: Applications of the following pipe and tube fitting materials are indicated in Part 3 "Piping Applications" Article.

Copper, Solder-Joint Pressure Fittings: ASME B16.18 cast-copper alloy or ASME B16.22 wrought copper.

Copper, Grooved-End Fittings: ASME B16.22 wrought copper and ASTM B 75 (ASTM B 75M) copper tube or ASME B16.18 cast-copper alloy and ASTM B 584 bronze castings. Copper-tubing sized grooved ends (flaring ends to accommodate alternate sized couplings is not permitted).

Copper, Press-to-Connect Pressure Fittings: ASME B16.18 cast-copper alloy or ASME B16.22 wrought copper, with 301 stainless steel internal components and EPDM seals.

Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

Copper Unions: ASME B16.18, cast-copper-alloy, hexagonal-stock body with ball-and-socket joint, metal-to-metal seating surfaces, and solder-joint, threaded, or solder-joint and threaded ends. Include threads conforming to ASME B1.20.1 on threaded ends.

Ductile-Iron, Mechanical or Push-on-Joint Fittings: AWWA C110, ductile- or gray-iron standard pattern; or AWWA C153, ductile-iron compact pattern; with 250 psig (1725 kPa) minimum pressure rating and AWWA C104 cement-mortar lining. Include AWWA C111 ductile- or gray-iron glands, rubber gaskets, and steel bolts with mechanical-joint fittings. Include AWWA C111 rubber gaskets with push-on-joint fittings.

Ductile-Iron, Mechanical Joint Fittings: AWWA C110, ductile- or gray-iron standard pattern; with 250 psig (1725 kPa) minimum pressure rating and AWWA C104 cement-mortar lining. Include AWWA C111 ductile- or gray-iron glands, rubber gaskets, and steel bolts.

Ductile-Iron, Push-on-Joint Fittings: AWWA C110, ductile- or gray-iron standard pattern; with 250 psig (1725 kPa) minimum pressure rating and AWWA C104 cement-mortar lining. Include AWWA C111 rubber gaskets.

Ductile-Iron, Mechanical Joint Fittings: AWWA C153, ductile-iron compact pattern; with 250 psig (1725 kPa) minimum pressure rating and AWWA C104 cement-mortar lining. Include AWWA C111 ductile- or gray-iron glands, rubber gaskets, and steel bolts.

Ductile-Iron, Push-on-Joint Fittings: AWWA C153, ductile-iron compact pattern; with 250 psig (1725 kPa) minimum pressure rating and AWWA C104 cement-mortar lining. Include AWWA C111 rubber gaskets.

Ductile-Iron, Flanged Fittings: AWWA C110, ductile- or gray-iron standard pattern; with 250 psig (1725 kPa) minimum pressure rating and AWWA C104 cement-mortar lining.

Schedule 40, PVC Socket Fittings: ASTM D2466.

JOINING MATERIALS:

General: Applications of the following piping joining materials are indicated in Part 3 "Piping Applications" Article.

Refer to Division 22 Section "Basic Mechanical Materials and Methods" for commonly used joining materials.

Solder: ASTM B 32, Alloy Sn95, Sn94, or E; lead free.

Brazing Filler Metal: AWS A5.8, BCuP, copper phosphorus or BAg, silver classification.

Copper, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections coated with copper-colored alkyd enamel and cast with offsetting angle-pattern bolt pads to provide rigidity, grade EHP gasket suitable for hot water, and bolts and nuts. Installation-Ready, for direct stab installation without field disassembly. Victaulic Style 607H.

A. Flange Adapter: Flat face, ductile iron housings with elastomer pressure responsive gasket, for direct connection to ANSI Class 150 flanged components. Victaulic Style 641.

Ductile-Iron, Keyed Couplings: AWWA C606 for ductile-iron-pipe dimensions. Include ferrous housing sections, FlushSeal® gasket suitable for hot water, and bolts and nuts. Victaulic Series 31.

A. Flange Adapter: Flat face, ductile iron housings with elastomer pressure responsive gasket, for direct connection to ANSI Class 125 flanged components. Victaulic Style 341.

Transition Couplings: Coupling or other manufactured fitting same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

A. Transition Couplings for Grooved Pipe: For direct transition from AWWA Ductile iron pipe to IPS / steel pipe sizes, couplings shall include housings cast with offsetting angle-pattern bolt pads to provide rigidity and FlushSeal® gasket. Victaulic Style 307.

Grooved Joint Lubricants: Lubricate gaskets in accordance with the manufacturer's recommendations with lubricant supplied by the coupling manufacturer that is suitable for the gasket elastomer and system media. Victaulic 'Vic-Lube'.

A. Gaskets shall be UL classified in accordance with ANSI/NSF-61 for Potable water service.

POLYETHYLENE ENCASEMENT:

Polyethylene Encasement for Ductile-Iron Piping: ASTM A674 or AWWA C105 polyethylene film, 0.008 inch (0.20 mm) minimum thickness, tube or sheet.

VALVES:

Refer to Division 22 Section "Valves" for general-duty valves.

Refer to Division 22 Section "Plumbing Specialties" for special-duty valves.

PART 3 EXECUTION

EXCAVATION:

Refer to Division 33 Section "Earthwork" for excavating, trenching, and backfilling.

PIPING APPLICATIONS:

Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

Flanges may be used on aboveground piping, unless otherwise indicated.

Underground, Service Entrance Piping: Do not use flanges or valves underground. Use the following:

- A. 3-1/2" NPS (DN90) and Smaller: Soft copper tube, Type K (Type A); copper, solder-joint pressure fittings; and soldered joints.
- B. 8" NPS (DN200) and Smaller: PVC, Schedule 40 pipe; PVC, Schedule 40 socket fittings; and solvent-cemented joints.
- C. 2-1/2" to 3-1/2" NPS (DN65 to DN90): 3- or 4-inch NPS (DN80 or DN100) ductile-iron pipe and fittings, and mechanical or push-on joints.
- D. 4" through 12" NPS (DN100 to DN300): Ductile-iron pipe and fittings, and mechanical or push-on joints.

Aboveground, Water Distribution Piping: Use the following:

- A. 1-1/2" NPS (DN40) and Smaller: Hard copper tube, Type L (Type B); copper, solder-joint fittings; and soldered joints.
- B. 1-1/2" NPS (DN40) and Smaller: Hard copper tube, Type L (Type B); copper, press-to-connect fittings and joints.
- C. 2" through 3-1/2" NPS (DN50 to DN90): Hard copper tube, Type L (Type B); copper, solder-joint fittings, and soldered joints or with grooved ends, copper, grooved-end fittings and copper keyed couplings.
- D. 4" to 8" NPS (DN100 to DN200): Hard copper tube, Type L (Type B) with grooved ends; copper, grooved-end fittings; and copper, keyed couplings.

Underground, Water Distribution Piping: Do not use flanges or valves underground. Use the following:

- A. 4" NPS (DN100) and Smaller: Soft copper tube, Type K (Type A); wrought-copper, solder-joint pressure fittings; and soldered joints.
- B. 8" NPS (DN150) and Smaller: PVC, Schedule 40 pipe; Schedule 40 socket fittings; and solvent-cemented joints.

Non-Potable Water Piping: Use the following:

- A. 1-1/2" NPS (DN40) and Smaller: Hard copper tube, Type L (Type B); copper, push-to-connect fittings and joints.
- B. 2"NPS (DN50) and Smaller: Hard copper tube, Type K (Type A); wrought-copper, solder-fittings; and soldered joints.
- B. 2" through 8" NPS (DN50 to DN150): Hard copper tube, Type L (Type B), with grooved ends; copper, grooved-end fittings; and copper, keyed couplings.

VALVE APPLICATIONS:

Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

- A. Shutoff Duty: Use ball or butterfly valves.

- B. Throttling Duty: Use ball or butterfly valves.

Grooved-end butterfly valves may be used with grooved-end piping.

PIPING INSTALLATION, GENERAL:

Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping installation.

SERVICE ENTRANCE PIPING INSTALLATION:

Extend service entrance piping to exterior water service piping in sizes and locations indicated for service entrances into building. Refer to Division 33 Section "Water Systems" for water service piping.

Install shutoff valve, RPZ backflow preventor, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside building at each service entrance pipe.

Install water-pressure regulators downstream from shutoff valves. Refer to Division 22 Section "Plumbing Specialties" for water-pressure regulators.

Ductile-Iron, Service Entrance Piping: Comply with AWWA C600. Install buried piping between shutoff valve and connection to water service piping with restrained joints. Anchor pipe to wall or floor at entrance. Include thrust-block supports at vertical and horizontal offsets.

- A. Encase piping with polyethylene film according to ASTM A674 or AWWA C105.

Install sleeve with water stop and mechanical sleeve seal at each service entrance pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.

WATER DISTRIBUTION PIPING INSTALLATION:

Install piping level without pitch.

JOINT CONSTRUCTION:

Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

Grooved Joints: Assemble joints with coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)

Press-to-Connect Joints: Install Permalynx joints in accordance with the manufacturer's latest published installation instructions. Prepare and mark tubing ends using a tool supplied by the manufacturer and in accordance with the manufacturer's instructions.

Solvent-Cemented, Thermoplastic Pipe and Fitting Joints: Handle cleaners, primers, and solvent cements according to ASTM F 402.

ROUGHING-IN FOR WATER METERS:

Rough-in water piping and install water meter(s) according to utility company's requirements. Water meters will be purchased by the Contractor from the local utility unless noted otherwise.

VALVE INSTALLATION:

Sectional Valves: Install sectional valves close to main on each branch and riser serving plumbing fixtures or equipment, and where indicated. Use ball valves for piping 2" NPS (DN50) and smaller. Use gate or butterfly valves for piping 2-1/2" NPS (DN65) and larger.

Shutoff Valves: Install shutoff valve on each water supply to equipment, on each supply to plumbing fixtures without supply stops, at all main fixture groups, branch lines off main, and where indicated. Use ball valves for piping 2" NPS (DN50) and smaller. Use gate or butterfly valves for piping 2-1/2" NPS (DN65) and larger.

Drain Valves: Install hose-end drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

Balancing Valves: Install in each hot-water circulation return branch, discharge side of each pump and circulator, and where indicated. Refer to Division 22 Section "Plumbing Specialties" for balancing valves.

HANGER AND SUPPORT INSTALLATION

Refer to Division 22 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:

- A. Riser clamps, MSS Type 8 or Type 42, for vertical runs.
- B. Adjustable steel clevis hangers, MSS Type 1, for individual, straight, horizontal runs 100 feet (30 m) and less.
- C. Adjustable roller hangers, MSS Type 43, for individual, straight, horizontal runs longer than 100 feet (30 m).
- D. Spring cushion rolls, MSS Type 49, if indicated, for individual, straight, horizontal runs longer than 100 feet (30 m).
- E. Pipe rolls, MSS Type 44, for multiple, straight, horizontal runs 100 feet (30 m) or longer. Support pipe rolls on trapeze.
- F. Spring hangers, MSS Type 52, for supporting base of vertical runs.

Install supports according to Division 22 Section "Hangers and Supports."

Support vertical piping and tubing at base and at each floor.

Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

Install hangers for copper tubing, steel, and ductile iron with the following maximum spacing:

- A. 1-1/2" NPS (DN40) and Smaller: Maximum horizontal spacing, 60 inches (1500 mm); maximum vertical spacing, 10 feet (3 m).
- B. 2" through 2-1/2" NPS (DN50 to DN65): Maximum horizontal spacing, 72 inches (1800 mm); maximum vertical spacing, 10 feet (3 m).
- C. 3" NPS (DN80) and Larger: Maximum horizontal spacing, 10 feet (3 m); maximum vertical spacing, 10 feet (3 m).

Install hangers for PVC plastic piping with the following maximum spacing and minimum rod

diameters:

- A. 8" NPS (DN200) and Smaller: Maximum horizontal spacing, 48 inches (1200 mm);

Minimum rod size to be according to manufacturer's written instructions for service conditions base on maximum hanger spacing.

Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

CONNECTIONS:

Connect service entrance piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.

Connect water distribution piping to service entrance piping at shutoff valve, and extend to and connect to the following:

- A. Plumbing Fixtures: Connect hot- and cold-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
- B. Equipment: Connect hot- and cold-water supply piping as indicated. Provide shutoff valve and union for each connection. Use flanges instead of unions for connections 2-1/2" NPS (DN65) and larger.
- C. Booster Systems: Connect cold-water suction and discharge piping.
- D. Water Heaters: Connect cold water supply and hot water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.

FIELD QUALITY CONTROL:

Inspect water distribution piping as follows:

Inspect service entrance piping and water distribution piping as follows:

- A. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- B. 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 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.
- C. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- D. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

Test service entrance piping and water distribution piping as follows:

- A. 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.
- B. Leave uncovered and unconcealed new, altered, extended, or replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
- C. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating

pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for 12 hours. Leaks and loss in test pressure constitute defects that must be repaired.

- D. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
- E. Prepare reports for tests and required corrective action.

CLEANING:

Clean and disinfect service entrance piping and water distribution piping as follows:

- A. Purge new piping and parts of existing water piping that have been altered, extended, or repaired before using.
- B. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed, procedure described in either AWWA C651 or AWWA C652 or as described below:
 - 1. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - 2. Fill and isolate system according to either of the following:
 - a. Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
 - b. Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for 3 hours.
 - 3. Flush system with clean, potable water until chlorine is no longer in water coming from system after the standing time.
 - 4. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows contamination.

Prepare and submit reports for purging and disinfecting activities.

Clean interior of piping system. Remove dirt and debris as work progresses.

COMMISSIONING:

Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

Perform the following steps before putting into operation:

- A. Close drain valves, hydrants, and hose bibbs.
- B. Open shutoff valves to fully open position.
- C. Open throttling valves to proper setting.
- D. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
- E. Remove and clean strainer screens. Close drain valves and replace drain plugs.

Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

Check plumbing specialties and verify proper settings, adjustments, and operation.

- A. Water-Pressure Regulators: Set outlet pressure at 80 psig (550 kPa) maximum, unless otherwise indicated.

Energize pumps and verify proper operation.

END OF SECTION

22 11 19 DOMESTIC WATER PIPING SPECIALTIES

PART 1 GENERAL**RELATED DOCUMENTS**

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

SUMMARY

This Section includes plumbing specialties for the following:

- A. Water distribution systems.

Related Sections include the following:

- A. Division 22 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, basic installation requirements, and labeling and identifying requirements; and escutcheons, dielectric fittings, sleeves, and sleeve seals that are not in this Section.
- B. Division 22 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.
- C. Division 22 Section "Meters and Gages" for thermometers, pressure gages, fittings, and water meters.
- D. Division 22 Section "Water Distribution Piping" for water-supply piping and connections.

SYSTEM PERFORMANCE REQUIREMENTS

Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

- A. Water Distribution Piping: 125 psig (860 kPa).

SUBMITTALS

Product Data: For each plumbing specialty indicated. Include rated capacities of selected equipment and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following plumbing specialty products:

- A. Backflow preventers.
- B. Water regulators.
- C. Balancing valves.
- D. Water filters.
- E. Strainers.
- F. Thermostatic water mixing valves and water tempering valves.
- G. Water hammer arresters.
- H. Trap seal primer valves and systems.
- I. Drain valves.
- J. Hose bibbs, hydrants, and sanitary post hydrants.
- K. Outlet boxes and washer-supply outlets.
- L. Sleeve penetration systems.

Reports: Specified in "Field Quality Control" Article.

Maintenance Data: For specialties to include in the maintenance manuals specified in Division 1. Include the following:

- A. Backflow preventers.
- B. Water regulators.
- C. Thermostatic water mixing valves and water tempering valves.
- D. Trap seal primer valves and systems.
- E. Sanitary hydrants.

QUALITY ASSURANCE

Product Options: Drawings indicate size, profiles, dimensional requirements, and characteristics of plumbing specialties and are based on the specific types and models indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

Provide listing/approval stamp, label, or other marking on plumbing specialties made to specified standards.

Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

Comply with NFPA 70, "National Electrical Code," for electrical components.

Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic potable-water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.

EXTRA MATERIALS

Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

- A. Operating Key Handles: Furnish one extra key for every five key-operated hose bibbs and hydrants installed.

PART 2 PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Backflow Preventers:
 - 1. Ames Co., Inc.
 - 2. Conbraco Industries, Inc.
 - 3. Watts Industries, Inc.; Water Products Div.
 - 4. Zurn Industries, Inc.; Wilkins Div.
- B. Water Regulators:
 - 1. Conbraco Industries, Inc.
 - 2. Honeywell Braukmann.
 - 3. Watts Industries, Inc.; Water Products Div.
 - 4. Zurn Industries, Inc.; Wilkins Div.

- C. Calibrated Balancing Valves:
 - 1. Armstrong Pumps, Inc.
 - 2. Flow Design, Inc.
 - 3. ITT Fluid Technology Corp.; ITT Bell & Gossett Div.
 - 4. Taco, Inc.
 - 5. Tour & Andersson, Inc.; Valve Div.
- D. Thermostatic Water Mixing Valves:
 - 1. Leonard Valve Co.
 - 2. Powers Process Controls.
 - 3. Symmons Industries, Inc.
 - 4. T & S Brass and Bronze Works, Inc.
- E. Water Tempering Valves:
 - 1. Conbraco Industries, Inc.
 - 2. Honeywell Braukmann.
 - 3. Leonard Valve Co.
 - 4. Sparco, Inc.
 - 5. Watts Industries, Inc.; Water Products Div.
- F. Outlet Boxes:
 - 1. Acorn Engineering Co.
 - 2. Guy Gray Manufacturing Co., Inc.
- G. Hydrants:
 - 1. Josam Co.
 - 2. Smith: Jay R. Smith Mfg. Co.
 - 3. Watts Industries, Inc.; Water Products Div.
 - 4. Woodford Manufacturing Co.
 - 5. Zurn Industries, Inc.; Hydromechanics Div.
- H. Water Hammer Arresters:
 - 1. Josam Co.
 - 3. Sioux Chief Manufacturing Co., Inc.
 - 3. Smith: Jay R. Smith Mfg. Co.
 - 4. Tyler Pipe; Wade Div.
 - 5. Watts Industries, Inc.; Water Products Div.
 - 6. Zurn Industries, Inc.; Hydromechanics Div.
- I. Trap Seal Primer Valves:
 - 1. Josam Co.
 - 2. Smith: Jay R. Smith Mfg. Co.
 - 3. Tyler Pipe; Wade Div.
 - 4. Watts Industries, Inc.; Ancon Drain Div.
 - 5. Zurn Industries, Inc.; Hydromechanics Div.
- J. Sleeve Penetration Systems:
 - 1. Calpico, Inc.
 - 2. Thunderline Corp.

BACKFLOW PREVENTERS

General: ASSE standard, backflow preventers, sized the same as connecting piping.

- A. 2-Inch NPS (DN50) and Smaller: Bronze body with threaded ends.

- B. 2-1/2-Inch NPS (DN65) and Larger: Bronze, cast-iron, steel, or stainless-steel body with flanged ends.
 - 1. Interior Lining: AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast-iron or steel body.
- C. Interior Components: Corrosion-resistant materials.
- D. Exterior Finish: Polished chrome-plate if used in chrome-plated piping system.
- E. Strainer on inlet.

Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.

Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with nonremovable and manual drain features, and ASME B1.20.7 garden-hose threads on outlet. Units attached to rough-bronze-finish hose connections may be rough bronze.

Intermediate Atmospheric-Vent Backflow Preventers: ASSE 1012, suitable for continuous pressure application. Include inlet screen and 2 independent check valves with intermediate atmospheric vent.

Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between 2 positive-seating check valves.

- A. Pressure Loss: 12 psig (83 kPa) maximum, through middle one-third of flow range.

Double-Check Backflow Prevention Assemblies: ASSE 1015, suitable for continuous pressure application. Include shutoff valves on inlet and outlet, and strainer on inlet; and test cocks with 2 positive-seating check valves.

- A. Pressure Loss: 10 psig (35 kPa) maximum, through middle one-third of flow range.

Antisiphon-Pressure-Type Vacuum Breakers: ASSE 1020, suitable for continuous pressure application. Include shutoff valves, spring-loaded check valve, spring-loaded floating disc, test cocks, and atmospheric vent.

- A. Pressure Loss: 5 psig (35 kPa) maximum, through middle one-third of flow range.

Dual-Check-Valve-Type Backflow Preventers: ASSE 1024, suitable for continuous pressure application. Include union inlet and 2 independent check valves.

Dual-Check-Valve-Type Backflow Preventers: ASSE 1032, suitable for continuous pressure application for carbonated beverage dispensers. Include stainless-steel body; primary and secondary checks; ball check; intermediate atmospheric-vent port for relieving carbon dioxide; and threaded ends, 3/8-inch NPS (DN10).

Laboratory Faucet Vacuum Breakers: ASSE 1035, suitable for continuous pressure application and chrome plated; consisting of primary and secondary checks; intermediate vacuum breaker; and threaded ends, 1/4- or 3/8-inch NPS (DN8 or DN10) as required.

Hose-Connection Backflow Preventers: ASSE 1052, suitable for at least 3-gpm (0.19-L/s) flow and applications with up to 10-foot head (30-kPa) back pressure. Include 2 check valves; intermediate atmospheric vent; and nonremovable, ASME 1.20.7 garden-hose thread on outlet.

Back-Siphonage Backflow Vacuum Breakers: ASSE 1056, suitable for continuous pressure and backflow applications. Include shutoff valves, check valve, test cocks, and vacuum vent.

WATER REGULATORS

General: ASSE 1003, water regulators, rated for initial working pressure of 150 psig (1034 kPa) minimum, of size, flow rate and inlet and outlet pressures indicated. Include integral factory-installed or separate field-installed Y-pattern strainer.

- A. 2-Inch NPS (DN50) and Smaller: Bronze body with threaded ends.
- B. 2-1/2-Inch NPS (DN65) and Larger: Bronze or cast-iron body with flanged ends. Include AWWA C550 or FDA-approved interior epoxy coating for regulators with cast-iron body.
- C. Interior Components: Corrosion-resistant materials.
- D. Exterior Finish: Polished chrome-plate if used in chrome-plated piping system.

Pilot operated type, single- or double-seated, cast-iron-body main valve, with bronze-body pilot valve.

On larger systems install a two stage regulator system with first, primary regulator sized for 0.5 gpm to 25 gpm and the secondary regulator sized for 25 gpm and higher.

BALANCING VALVES

Calibrated Balancing Valves: Adjustable, with 2 readout ports and memory setting indicator. Include manufacturer's standard hoses, fittings, valves, differential pressure meter, and carrying case.

- A. 2-Inch NPS (DN50) and Smaller: Bronze body with brass ball, adjustment knob, calibrated nameplate, and threaded or solder-joint ends.
- B. 2-Inch NPS (DN50) and Smaller: Bronze, Y-pattern body with adjustment knob and threaded ends.
- C. 2-1/2-Inch NPS (DN65) and Larger: Cast-iron, Y-pattern body with bronze disc and flanged or grooved ends.

THERMOSTATIC WATER MIXING VALVES

General: ASSE 1017, manually adjustable, thermostatic water mixing valve with bronze body. Include check stop and union on hot- and cold-water-supply inlets, adjustable temperature setting, and capacity at pressure loss as indicated.

- A. Bimetal Thermostat, Operation and Pressure Rating: 125 psig (860 kPa) minimum.

Thermostatic Water Mixing Valves: Unit, with the following:

- A. Piping, of sizes and in arrangement indicated. Include valves and unions.
- B. Piping Component Finish: Polished chrome-plate.
- C. Cabinet: Stainless-steel box with stainless-steel hinged door.
- D. Cabinet Mounting: Surface mounted.
- E. Thermometer: Manufacturer's standard.

WATER TEMPERING VALVES

General: Manually adjustable, thermostatically controlled water tempering valve; bronze body; and adjustable temperature setting.

System Water Tempering Valves: Piston or discs controlling both hot- and cold-water flow, capable of limited antiscald protection. Include threaded inlets and outlet, capacity at pressure loss, and temperature range or setting as indicated.

- A. Finish: Rough bronze unless chrome-plated finish is indicated.

Limited-Volume, Water Tempering Valves: Solder-joint inlets and 3/4-inch NPS (DN20) maximum outlet, with minimum capacity and maximum pressure loss as indicated.

STRAINERS

Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch (1.2-mm) round perforations, unless otherwise indicated.

- A. Pressure Rating: 125-psig (860-kPa) minimum steam working pressure, unless otherwise indicated.
- B. 2-Inch NPS (DN50) and Smaller: Bronze body, with female threaded ends.
- C. 2-1/2-Inch NPS (DN65) and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved epoxy coating and flanged ends.
- D. Y-Pattern Strainers: Screwed screen retainer with centered blowdown.
 - 1. Drain: Factory- or field-installed, hose-end drain valve.
- E. T-Pattern Strainers: Malleable-iron or ductile-iron body with grooved ends; access end cap with drain plug and access coupling with rubber gasket.
- F. Basket Strainers: Bolted flange or clamp cover, and basket with lift-out handle.
 - 1. Simplex Type: Single unit, with one basket.
 - 2. Duplex Type: Double unit, with bronze or stainless-steel diverter valve and 2 baskets.
 - 3. Drain: Factory- or field-installed, hose-end drain valve.

Drainage Basket Strainers: Non-pressure-rated, cast-iron or coated-steel body; with bolted flange or clamp cover and drain with plug.

- A. Basket: Bronze or stainless steel with 1/8- or 3/16-inch- (3.2- or 4.8-mm-) diameter holes and lift-out handle.
- B. Female threaded ends for 2-inch NPS (DN50) and smaller, and flanged ends for 2-1/2-inch NPS (DN65) and larger.

OUTLET BOXES

General: Recessed-mounting outlet boxes with fittings complying with ASME A112.18.1M. Include box with faceplate, services indicated for equipment connections, and wood-blocking reinforcement.

Clothes Washer Outlet Boxes: With hose connections, drain, and the following:

- A. Box and Faceplate: Stainless steel.
- B. Supply Fittings: Two 1/2-inch NPS (DN15) gate or ball valves and 1/2-inch NPS (DN15) copper, water tubing.
- A. Drain Fitting: 2-inch NPS (DN50) drainage piping P-trap with 2-inch NPS (DN50) standpipe extending from floor to outlet box and 2-inch NPS (DN50) waste.

Ice Maker Outlet Boxes: With hose connection and the following:

- A. Box and Faceplate: Stainless steel.

- B. Supply Fitting: 1/2-inch NPS (DN15) gate or ball valve and 1/2-inch NPS (DN15) copper, water tubing.

HYDRANTS

Wall Hydrants: ASME A112.21.3M or ASSE 1019, nonfreeze, automatic draining, antibackflow type, key operation, with 3/4- or 1-inch NPS (DN20 or DN25) threaded or solder-joint inlet, and ASME B1.20.7 garden-hose threads on outlet. Include operating key for each hydrant.

- A. Type: Recessed.
- B. Finish: Polished bronze.

SANITARY POST HYDRANTS

Description: Nonfreeze, post hydrant with non-draining chamber for storing water trapped downstream from inlet valve.

- A. Inlet: 1-inch NPS (DN25) threaded.
- B. Outlet: Integral or field-installed, nonremovable, drainable, hose-connection vacuum breaker with ASME B1.20.7 garden-hose threads on outlet. Include brass or bronze casing and other parts in contact with water, and handle or key operation. Include operating key for each hydrant.
- C. Length: As required for installing storage chamber below frost line. Use of draining-type post hydrant for this application is prohibited.

TRAP SEAL PRIMER VALVES

Trap Seal Primer Valves: ASSE 1018, water-supply-fed type, with the following characteristics:

- A. 125-psig (860-kPa) minimum working pressure.
- B. Bronze body with atmospheric-vented drain pressure.
- C. Inlet and Outlet Connections: 1/2-inch NPS (DN15) threaded, union, or solder joint.
- D. Gravity Drain Outlet Connection: 1/2-inch NPS (DN15) threaded or solder joint.
- E. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

TRAP GUARDS

Trap Sewer Gas and Backup Protection: Smooth, soft, flexible, elastomeric PVC material molded into shape of duck's bill, open on top with curl closure at bottom. Guard to allow wastewater to discharge through interior and close to original shape after discharge. ASME A112.6.3. NSF/ANSI 14. Sized to match floor drain strainer.

DRAIN VALVES

Hose-End Drain Valves: MSS SP-110, 3/4-inch NPS (DN20) ball valve, rated for 400-psig (2760-kPa) minimum CWP. Include 2-piece, ASTM B 62 bronze body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, and vinyl-covered steel handle.

- A. Inlet: Threaded or solder joint.
- B. Outlet: Short-threaded nipple with ASME B1.20.7 garden-hose thread and cap.

MISCELLANEOUS PIPING SPECIALTIES

Water Hammer Arresters: ASME A112.26.1M, ASSE 1010, or PDI-WH 201, bellows or piston type with pressurized cushioning chamber. Sizes are based on water-supply fixture units, ASME A112.26.1M sizes A through F and PDI-WH 201 sizes A through F.

Hose Bibbs: Bronze body, with renewable composition disc, ½- or ¾-inch NPS (DN15 or DN20) threaded or solder-joint inlet. Provide ASME B1.20.7 garden-hose threads on outlet and integral or field-installed, nonremovable, drainable, hose-connection vacuum breaker.

- A. Finish: Chrome or nickel plated.
- B. Operation: Operating-key (handle) type. Include operating key.

Roof Flashing Assemblies: Manufactured assembly made of 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch- (1.6-mm-) thick, lead flashing collar and skirt extending at least 8 inches (200 mm) from pipe with galvanized steel boot reinforcement, and counterflashing fitting.

- A. Vent Cap: Open top, without cap.

SLEEVE PENETRATION SYSTEMS

Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.

Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.

FLASHING MATERIALS

Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

- A. General Use: 4 lb/sq. ft. or 0.0625-inch thickness (20 kg/sq. m or 1.6-mm thickness).
- B. Vent Pipe Flashing: 3 lb/sq. ft. or 0.0469-inch thickness (15 kg/sq. m or 1.2-mm thickness).
- C. Burning: 6 lb/sq. ft. or 0.0937-inch thickness (30 kg/sq. m or 2.4-mm thickness).

Zinc-Coated Steel Sheet: ASTM A 653 (ASTM A 653M), with 0.20 percent copper content and 0.04-inch (1.016-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1-mm) minimum thickness.

Fasteners: Metal compatible with material and substrate being fastened.

Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 EXECUTION

PLUMBING SPECIALTY INSTALLATION

General: Install plumbing specialty components, connections, and devices according to manufacturer's written instructions.

Install backflow preventers of type, size, and capacity indicated, at each water-supply connection to mechanical equipment and systems, and to other equipment and water systems as indicated. Comply with authorities having jurisdiction. Locate backflow preventers in same room as connected equipment. Install air-gap fitting on units with atmospheric-vent connection and pipe relief outlet drain to nearest floor drain. Do not install bypass around backflow preventer.

Install pressure regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet. Regulators are to be installed on water services exceeding 80 psi whether indicated on the plans or not.

Install strainers on supply side of each control valve, pressure regulator, and solenoid valve, and where indicated.

Install hose bibbs with integral or field-installed vacuum breaker.

Install wall hydrants with integral vacuum breaker.

Install trap seal primer valves with valve outlet piping pitched down toward drain trap a minimum of one percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

Install backwater valves in building drain piping as indicated. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

Install expansion joints on vertical risers, stacks, and conductors as indicated.

Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

Fasten recessed, wall-mounting plumbing specialties to reinforcement built into walls.

Secure supplies to supports or substrate.

Install individual stop valve in each water supply to plumbing specialties. Use ball or globe valve if specific valve is not indicated.

Install water-supply stop valves in accessible locations.

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.

Include wood-blocking reinforcement for recessed and wall-mounting plumbing specialties.

CONNECTIONS

Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

- A. Install piping connections between plumbing specialties and piping specified in other Division 22 Sections.

- B. Install piping connections indicated between appliances and equipment specified in other Sections; connect directly to plumbing piping systems.
- C. Install piping connections indicated as indirect wastes from appliances and equipment specified in other Sections, to spill over receptors connected to plumbing piping systems.

Install hoses between plumbing specialties and appliances as required for connections.

Arrange for electric-power connections to plumbing specialties and devices that require power. Electric power is specified in Division 26 Sections.

Supply Runouts to Plumbing Specialties: Install hot- and cold-water-supply piping of sizes indicated, but not smaller than required by authorities having jurisdiction.

Ground electric-powered plumbing specialties.

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

Arrange for electric-power connections to plumbing specialties and devices that require power. Electric power, wiring, and disconnect switches are specified in Division 26 Sections.

FLASHING INSTALLATION

Fabricate flashing manufactured from single piece unless large pans, sumps, or other drainage shapes are required.

Burn joints of lead sheets where required.

Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

- A. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (2500 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
- B. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
- C. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

Set flashing on floors and roofs in solid coating of bituminous cement.

Secure flashing into sleeve and specialty clamping ring or device.

Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 7 Section "Sheet Metal Flashing and Trim."

Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having caulking recess.

Fabricate and install flashing and pans, sumps, and other drainage shapes as indicated. Install drain connection if indicated.

FIELD QUALITY CONTROL

Manufacturer's Field Service: Provide services of factory-authorized service representative to supervise the field assembly of components and installation of grease recovery units, including piping and electrical connections, and to report results in writing.

- A. Test and adjust plumbing specialty controls and safeties. Replace damaged and malfunctioning controls and components.

COMMISSIONING

Before startup, perform the following checks:

- A. System tests are complete.
- B. Damaged and defective specialties and accessories have been replaced or repaired.
- C. Clear space is provided for servicing specialties.

Before operating systems, perform the following steps:

- A. Close drain valves, hydrants, and hose bibbs.
- B. Open general-duty valves to fully open position.
- C. Remove and clean strainers.
- D. Verify that drainage and vent piping are clear of obstructions. Flush with water until clear.

Startup Procedures: Follow manufacturer's written instructions. If no procedures are prescribed by manufacturer, proceed as follows:

- A. Energize circuits for electrically operated units. Start and run units through complete sequence of operations.

Adjust operation and correct deficiencies discovered during commissioning.

DEMONSTRATION

Startup Services: Engage a factory-authorized service representative to perform startup services and train Owner's maintenance personnel as specified below:

- A. Train Owner's maintenance personnel on procedures and schedules related to startup of and servicing interceptors.
- B. Train Owner's maintenance personnel on procedures and schedules related to startup of and servicing grease recovery units.
- C. Review data in the maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
- D. Schedule training with Owner with at least 7 days' advance notice.

PROTECTION

Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

- A. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

22 13 16 SANITARY WASTE AND VENT PIPING

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes sanitary drainage and vent piping, and storm drainage piping inside building and to locations indicated.

Related Sections include the following:

- A. Division 33 Section "Sewerage and Drainage" for sanitary sewerage and storm drainage.
- B. Division 33 Section "Foundation Drainage Systems" for foundation drains.
- C. Division 22 Section "Plumbing Specialties" for drainage and vent piping system specialties.

DEFINITIONS:

Sewerage Piping: Building sewer piping outside building that conveys sanitary sewage from building.

Storm Drainage Piping: Building sewer piping outside building that conveys storm drainage from building.

Service Entrance Piping: Drainage piping at entry into building between outside building sewer piping and inside drainage piping.

Drainage and Vent Piping: Piping inside building that conveys waste water and vapors from fixtures and equipment throughout the building.

Forced-Main Piping: Drainage piping, under pressure.

The following are industry abbreviations for plastic and other piping materials:

- A. ABS: Acrylonitrile-butadiene-styrene.
- B. EPDM: Ethylene-propylene-diene polymer, rubber.
- C. NBR: Acrylonitrile-butadiene rubber.
- D. PVC: Polyvinyl chloride.

SYSTEM PERFORMANCE REQUIREMENTS:

Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

- A. Soil, Waste, and Vent Systems: 10-foot head of water (30 kPa).
- B. Storm Drainage Systems: 10-foot head of water (30 kPa).
- C. Sewage, Forced-Main Piping Systems: 100 psig (690 kPa).

SUBMITTALS:

Test Results and Reports: Specified in "Field Quality Control" Article.

QUALITY ASSURANCE:

Provide listing/approval stamp, label, or other marking on piping made to specified standards.

Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

All cast iron soil pipe and fittings shall be marked with a collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

PART 2 PRODUCTS**PIPES AND TUBES:**

General: Applications of the following pipe and tube materials are indicated in Part 3 "Piping Applications" Article.

Hub-and-Spigot, Cast-Iron Soil Pipe: ASTM A 74, Service and Extra Heavy classes. Include ASTM C 564 rubber gasket, with dimensions required for pipe class, for each hub.

Hubless, Cast-Iron Soil Pipe: ASTM A 888 or CISPI Standard 301.

Soft Copper Tube: ASTM B88, Type K (ASTM B88M, Type A), water tube, annealed temper.

Hard Copper Tube: ASTM B88, Type L (ASTM B88M, Type B), water tube, drawn temper.

Hard Copper Tube: ASTM B306, drainage tube, drawn temper.

PVC Plastic Pipe: ASTM D2665, Schedule 40.

PIPE AND TUBE FITTINGS:

General: Applications of the following pipe and tube fitting materials are indicated in Part 3 "Piping Applications" Article.

Threaded-Fitting, End Connections: ASME B1.20.1.

Hub-and-Spigot, Cast-Iron, Soil-Pipe Fittings: ASTM A 74, Service and Extra Heavy classes, hub and spigot. Include ASTM C 564 rubber gasket, with dimensions required for pipe class, for each hub.

Hubless, Cast-Iron, Soil-Pipe Fittings: CISPI Standard 301.

Cast-Iron, Solvent Fittings: ASME B16.45 drainage-pattern aerator and dearator.

Copper, Solder-Joint Drainage Fittings: ASME B16.23 cast copper or ASME B16.29 wrought copper.

Copper Solvent Fittings: ASME B16.32 cast copper, drainage-pattern aerator and dearator.

Copper, Solder-Joint Pressure Fittings: ASME B16.18 cast-copper alloy or ASME B16.22 wrought copper. Furnish wrought-copper fittings if indicated.

Copper, Grooved-End Fittings: ASTM B75 (ASTM B75M) copper tube or ASTM B584 bronze castings.

Bronze Flanges: ASME B16.24, Class 150, bronze, with solder-joint end.

Copper Unions: ASME B16.18, cast-copper-alloy, hexagonal-stock body with ball and socket joint, metal to metal seating surfaces, and solder joint, threaded, or solder joint and threaded ends

Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal stock body with ball and socket joint, metal to metal bronze seating surfaces, and female threaded ends with threads according to ASME B1.20.1.

Cast-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.

Cast-Iron, Threaded Drainage Fittings: ASME B16.12, galvanized, recessed, drainage pattern.

Cast-Iron, Threaded Flanges: ASME B16.1, Class 125.

PVC Socket Fittings: ASTM D2665, made to ASTM D3311 drain, waste and vent pipe patterns.

PVC Plastic, Tubular Fittings: ASTM F409 drainage pattern, with ends as required for application.

JOINING MATERIALS:

General: Applications of the following piping joining materials are indicated in Part 3 "Piping Applications" Article.

Refer to Division 22 Section "Basic Mechanical Materials and Methods" for commonly used joining materials.

Solder: ASTM B 32, Alloy Sn95, Sn94, or E; lead free.

Hubless, Cast-Iron, Soil-Piping Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve or gasket with integral, center pipe stop. Include the following:

- A. Heavy-Duty, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel housing or shield; and stainless-steel clamps. Include gasket.
 - 1. Clamp Width: 3 inches (75 mm) wide with 4 clamps, for piping 1-1/2- to 4-inch NPS (DN40 to DN100).
 - 2. Clamp Width: 4 inches (100 mm) wide with 6 clamps, for piping 5- to 10-inch NPS (DN125 to DN250).

Copper, Keyed Couplings: Copper tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for water, and nuts and bolts.

Transition Couplings: Coupling or other manufactured fitting same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

Flexible, Transition Couplings for Underground, Non-pressure Piping: ASTM C1173 with elastomeric sleeve. Include ends same sizes as piping to be joined and include corrosion-resistant metal band on each end.

Sleeve Type for Plain-End Piping: Rubber or elastomeric sleeve and stainless-steel band assembly, fabricated to match outside diameters of piping to be joined. Include the following:

- A. Sleeves for Cast-Iron Soil Piping: ASTM C564 rubber.
- B. Sleeves for Plastic Piping: ASTM F477 elastomeric seal.
- C. Sleeves for Dissimilar Piping: Compatible with piping materials to be joined.
- D. Bands: Stainless-steel, one at each pipe insert.

Gasket Type for Dissimilar-End Piping: Rubber or elastomeric compression gasket, made to match inside diameter of pipe or hub, and outside diameter of adjoining pipe. Include the following:

- A. Gaskets for Cast-Iron Piping: ASTM C564 rubber.
- B. Gaskets for Plastic Piping: ASTM F477 elastomeric seal.
- C. Gaskets for Dissimilar Piping: Compatible with piping materials to be joined.

VALVES:

Refer to Division 22 Section "Valves" for general-duty valves. Use valves specified for "Domestic Water Systems" applications.

PART 3 EXECUTION

EXCAVATION:

Refer to Division 33 Section "Earthwork" for excavating, trenching, and backfilling.

PIPING APPLICATIONS:

Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

Flanges may be used on aboveground piping, unless otherwise indicated.

Aboveground, Soil, Waste, and Vent Piping: Use the following:

- A. 1-1/2" through 10" NPS (DN40 to DN200): Hubless, cast-iron soil pipe; hubless, cast-iron, soil-pipe fittings; and heavy-duty, Type 304, stainless steel hubless, cast-iron, soil-piping couplings.
- B. 1-1/4" through 4" NPS (DN32 to DN100): Hard copper drainage tube; copper, solder-joint drainage fittings; and soldered joints.
- C. 2" through 8" NPS (DN50 to DN200): Hard copper drainage tube; copper, grooved-end fittings; and copper, keyed couplings.

Underground, Soil, Waste, and Vent Piping: Use the following:

- A. 1-1/2" through 12" NPS (DN40 to DN300): PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
- B. 2" through 10" NPS (DN50 to DN250): Hub and spigot, cast-iron soil pipe, service class; hub and spigot, cast-iron, soil pipe fittings, service class; and compression joints.
- C. 12" through 15" NPS (DN300 to DN375): Hub and spigot, cast-iron soil pipe, extra heavy class; hub and spigot, cast-iron, soil pipe fittings, extra heavy class; and compression joints.

VALVE APPLICATIONS:

Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

- A. Shutoff Duty: Use gate, ball, or butterfly valves.

B. Throttling Duty: Use globe, ball, or butterfly valves.

Grooved-end butterfly valves may be used with grooved-end piping.

PIPING INSTALLATION, GENERAL:

Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping installation.

SERVICE ENTRANCE PIPING INSTALLATION:

Refer to Division 33 Section "Sewerage and Drainage" for sanitary and storm sewer piping.

Extend building sanitary drain piping and connect to sanitary sewer piping in sizes and locations indicated for service entrances into building. Install cleanout and extension to grade at connections of building sanitary drains with building sanitary sewers.

Install sleeve with water stop and mechanical sleeve seal at each service entrance pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.

DRAINAGE AND VENT PIPING INSTALLATION:

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."

Make changes in direction for 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 make change in direction of flow greater than 90 degrees. Use proper size of standard increasers and reducers if different sizes of piping are connected. Reducing size of drainage piping in direction of flow is prohibited.

Lay buried building drain 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.

Install drainage and vent piping at the following minimum slopes, unless otherwise indicated:

- A. Sanitary Building Drain: 2 percent downward in direction of flow for piping 3-inch NPS (DN80) and smaller; 1 percent downward in direction of flow for piping 4-inch NPS (DN100) and larger.
- B. Horizontal, Sanitary Drainage Piping: 2 percent downward in direction of flow.
- C. Vent Piping: 1/2 percent down toward vertical fixture vent or toward vent stack.

Sleeves are not required for cast-iron soil piping passing through concrete slab on grade if slab is without membrane waterproofing.

Install PVC plastic drainage piping according to ASTM D2665.

Install underground PVC plastic drainage piping according to ASTM D2321.

JOINT CONSTRUCTION:

Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

- A. Compression Joints: Make with rubber gasket matching class of pipe and fittings.
- B. Hubless Joints: Make with rubber gasket and sleeve or clamp.

Grooved Joints: Assemble joints with coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's instructions.

PVC Piping Joints: Join drainage piping according to ASTM D2665.

Handling of Solvent Cements, Primers, and Cleaners: Comply with procedures in ASTM F402 for safe handling during joining of plastic pipe and fittings.

VALVE INSTALLATION:

Shutoff Valves: Install shutoff valve on each pump discharge and where indicated. Use gate or ball valves for piping 2" NPS (DN50) and smaller. Use gate or butterfly valves for piping 2-1/2" NPS (DN65) and larger.

Check Valves: Install swing check valve on each pump discharge, downstream from shutoff valve.

HANGER AND SUPPORT INSTALLATION:

Refer to Division 22 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:

- A. Riser clamps, MSS Type 8 or Type 42, for vertical runs.
- B. Adjustable steel clevis hangers, MSS Type 1, for individual, straight, horizontal runs 100 feet (30 m) and less.
- C. Adjustable roller hangers, MSS Type 43, for individual, straight, horizontal runs longer than 100 feet (30 m).
- D. Spring cushion rolls, MSS Type 49, if indicated, for individual, straight, horizontal runs longer than 100 feet (30 m).
- E. Pipe rolls, MSS Type 44, for multiple, straight, horizontal runs 100 feet (30 m) or longer. Support pipe rolls on trapeze.
- F. Spring hangers, MSS Type 52, for supporting base of vertical runs.

Install supports according to Division 22 Section "Hangers and Supports."

Support vertical piping and tubing at base and at each floor.

Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

Install hangers for copper tubing, stainless steel, and ductile-iron with the following maximum spacing:

- A. 1-1/2" NPS (DN40) and Smaller: Maximum horizontal spacing, 60 inches (1500 mm); maximum vertical spacing, 10 feet (3 m).
- B. 2" through 2-1/2" NPS (DN 50 to DN65): Maximum horizontal spacing, 72 inches (1800 mm); maximum vertical spacing, 10 feet (3 m).
- C. 3" NPS (DN80) and Larger: Maximum horizontal spacing, 10 feet (3 m); maximum vertical

spacing, 10 feet (3 m).

Install hangers for cast-iron soil piping with the following maximum spacing:

- A. 1-1/2" through 15" NPS (DN40 to DN375): Maximum horizontal spacing, 60 inches (1500 mm); maximum vertical spacing, 15 feet (4.5 m).

Minimum rod size to be according to manufacturer's written instructions for service conditions based on maximum hanger spacing.

Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

CONNECTIONS:

Connect service entrance piping to exterior sewerage and drainage piping. Use transition fitting to join dissimilar piping materials.

Connect drainage piping to service entrance piping, and extend to and connect to the following:

- A. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."
- B. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Specialties."
- C. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections 2-1/2-inch NPS (DN65) and larger.

FIELD QUALITY CONTROL:

Inspect drainage and vent piping as follows:

- A. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- B. 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 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.
- C. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- D. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

Test drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedure, as follows:

- A. 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.
- B. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
- C. 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 feet of head (30 kPa). Water level must not drop for 12 hour duration of test. Inspect joints for leaks.

- D. 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 (250 Pa). 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.
- E. Repair leaks and defects using new materials and retest piping or portion thereof until satisfactory results are obtained.
- F. Prepare reports for tests and required corrective action.

CLEANING AND PROTECTING:

Clean interior of piping system. Remove dirt and debris as work progresses.

Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

Place plugs in ends of uncompleted piping at end of day and when work stops.

Exposed PVC Piping: Protect plumbing vents exposed to sunlight with 2 coats of water-based latex paint.

END OF SECTION

22 13 19 SANITARY WASTE PIPING SPECIALTIES

PART 1 GENERAL**RELATED DOCUMENTS**

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

SUMMARY

This Section includes plumbing specialties for the following:

- A. Soil, waste, and vent systems.

Related Sections include the following:

- A. Division 22 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, basic installation requirements, and labeling and identifying requirements; and escutcheons, dielectric fittings, sleeves, and sleeve seals that are not in this Section.
- B. Division 22 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.
- C. Division 22 Section "Meters and Gages" for thermometers, pressure gages, fittings, and water meters.
- D. Division 22 Section "Water Distribution Piping" for water-supply piping and connections.
- E. Division 22 Section "Waste and Vent Piping" for drainage and vent piping and connections.

SYSTEM PERFORMANCE REQUIREMENTS

Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

- A. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).
- B. Force-Main Piping: 100 psig (690 kPa).

SUBMITTALS

Product Data: For each plumbing specialty indicated. Include rated capacities of selected equipment and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following plumbing specialty products:

- A. Strainers.
- B. Drain valves.
- C. Backwater valves.
- D. Cleanouts.
- E. Floor drains, open receptors, and trench drains.
- F. Vent caps, vent terminals, and roof flashing assemblies.
- G. Grease interceptors, grease recovery units, oil interceptors, oil storage tanks, and solids interceptors.
- H. Sleeve penetration systems.

Reports: Specified in "Field Quality Control" Article.

Maintenance Data: For specialties to include in the maintenance manuals specified in Division 1. Include the following:

- A. Backwater valves.
- B. Grease interceptors, grease recovery units, oil interceptors, oil storage tanks, and solids interceptors.

QUALITY ASSURANCE

Product Options: Drawings indicate size, profiles, dimensional requirements, and characteristics of plumbing specialties and are based on the specific types and models indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

Provide listing/approval stamp, label, or other marking on plumbing specialties made to specified standards.

Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

Comply with NFPA 70, "National Electrical Code," for electrical components.

Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic potable-water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.

PART 2 PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Backwater Valves:
 - 1. Josam Co.
 - 2. Smith: Jay R. Smith Mfg. Co.
 - 3. Watts Industries, Inc.; Ancon Drain Div.
 - 4. Zurn Industries, Inc.; Hydromechanics Div.
- B. Sleeve Penetration Systems:
 - 1. Calpico, Inc.
 - 2. Thunderline Corp.

DRAIN VALVES

Hose-End Drain Valves: MSS SP-110, 3/4-inch NPS (DN20) ball valve, rated for 400-psig (2760-kPa) minimum CWP. Include 2-piece, ASTM B 62 bronze body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, and vinyl-covered steel handle.

- A. Inlet: Threaded or solder joint.
- B. Outlet: Short-threaded nipple with ASME B1.20.7 garden-hose thread and cap.

BACKWATER VALVES

Horizontal Backwater Valves: ASME A112.14.1, cast-iron body, with removable bronze swing-check valve and threaded or bolted cover.

- A. Closed-Position Check Valve: Factory assembled or field modified to hang closed unless subject to backflow condition.
- B. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor, instead of cover.

Drain Outlet Backwater Valves: Cast-iron or bronze body, with removable ball float, threaded inlet, and threaded or spigot outlet.

MISCELLANEOUS PIPING SPECIALTIES

Roof Flashing Assemblies: Manufactured assembly made of 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch- (1.6-mm-) thick, lead flashing collar and skirt extending at least 8 inches (200 mm) from pipe with galvanized steel boot reinforcement, and counter flashing fitting.

- A. Vent Cap: Open top, without cap.

Open Drains: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section of length to provide depth indicated; and where indicated, increaser fitting of size indicated, joined with ASTM C 564 rubber gaskets. Size P-trap as indicated.

Deep-Seal Traps: Cast iron or bronze, with inlet and outlet matching connected piping, cleanout where indicated, and trap seal primer valve connection where indicated.

- A. 2-Inch NPS (DN50): 4-inch- (100-mm-) minimum water seal.
- B. 2-1/2 Inch NPS (DN65) and Larger: 5-inch- (125-mm-) minimum water seal.

Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.

Air-Gap Fittings: ASME A112.1.2, cast iron or cast bronze, with fixed air gap, inlet for drain pipe or tube, and threaded or spigot outlet.

SLEEVE PENETRATION SYSTEMS

Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.

Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.

Stack Fitting: ASTM A 48, cast-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and cast-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.

- A. Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical waste and vent stacks.

FLASHING MATERIALS

Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

- A. General Use: 4 lb/sq. ft. or 0.0625-inch thickness (20 kg/sq. m or 1.6-mm thickness).
- B. Vent Pipe Flashing: 3 lb/sq. ft. or 0.0469-inch thickness (15 kg/sq. m or 1.2-mm thickness).

C. Burning: 6 lb/sq. ft. or 0.0937-inch thickness (30 kg/sq. m or 2.4-mm thickness).

Zinc-Coated Steel Sheet: ASTM A 653 (ASTM A 653M), with 0.20 percent copper content and 0.04-inch (1.016-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1-mm) minimum thickness.

Fasteners: Metal compatible with material and substrate being fastened.

Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

CLEANOUTS

Cleanouts (C.O.): Where plumbing specialties of this designation are indicated, provide products complying with the following:

- A. Applicable Standard: ASME A112.36.2M.
- B. Products: Subject to compliance with requirements, provide products equal to the following:
 - 1. Finished Walls: Zurn Z1446-BP bronze plug with stainless steel wall access cover.
 - 2. Finished Floors: Zurn ZB1400 adjustable floor level cleanout with polished bronze scoriated top flush with floor.
 - 3. Carpeted Floor: Zurn ZB1400-CM adjustable floor level cleanout with polished bronze top and carpet retainer.
 - 4. Outside Building: Zurn Z1402 cast iron cleanout extension with bronze plug set in cast iron meter box with cover. Cleanout plug 6" below cover set in concrete.
- C. Body or Ferrule Material: Cast iron.
- D. Clamping Device: Required.
- E. Outlet Connection: Threaded.
- F. Closure: Brass plug with straight threads and gasket.
- G. Adjustable Housing Material: Cast iron with threads.
- H. Frame and Cover Shape: Round.
- I. Acceptable Manufacturer's:
 - 1. Zurn Industries, Inc., Hydromechanics Div.
 - 2. Josam Co.
 - 3. Smith: Jay R. Smith Mfg. Co.
 - 4. Tyler Pipe, Wade Div.
 - 5. Watts Industries, Inc., Ancon Drain Div.

FLOOR-DRAINS

Floor Drain (X"-FD): Where plumbing specialties of this designation are indicated, provide products complying with the following:

- A. Applicable Standard: ASME A112.21.1M.
- B. Products: Subject to compliance with requirements, provide products equal to the following:
 - 1. Zurn ZN415O nickel bronze, raised lip strainer in linoleum or asphaltic tile floors.
 - 2. Zurn ZN415S nickel bronze square strainer in tile or terrazo floors.
 - 3. Zurn ZN415E nickel bronze strainer and 4" funnel for drop drains where indicated in construction documents.

4. Zurn ZN415B nickel bronze strainer for general floor drain. Provide 5" strainer on 2" drains, 6" strainer on 3" drains, and 8" strainer on 4" drains.
 5. Zurn Z610 by boilers, AHU's, etc., with 3/4" grate as marked B.D. in construction documents.
 6. Zurn Z1752-Y-3 in kitchens, stainless steel, 3/4" grate, 10" deep, with aluminum sediment bucket as marked F.S. in construction documents.
- C. Body Material: Cast iron.
- D. Seepage Flange: Required.
- E. Clamping Device: Required.
- F. Outlet: Bottom unless otherwise noted.
- G. Trap Material: Cast iron or PVC to match connection piping.
- H. Trap Pattern: Deep-seal P-trap.
- I. Acceptable Manufacturer's:
1. Zurn Industries, Inc., Hydromechanics Div.
 2. Josam Co.
 3. Smith: Jay R. Smith Mfg. Co.
 4. Tyler Pipe, Wade Div.
 5. Watts Industries, Inc., Ancon Drain Div.

PART 3 EXECUTION

PLUMBING SPECIALTY INSTALLATION

General: Install plumbing specialty components, connections, and devices according to manufacturer's written instructions.

Install trap seal primer valves with valve outlet piping pitched down toward drain trap a minimum of one percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

Install backwater valves in building drain piping as indicated. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

Install expansion joints on vertical risers, stacks, and conductors as indicated.

Install cleanouts in aboveground piping and building drain piping as indicated, and according to Code, according to the following:

- A. Size same as drainage piping up to 4-inch NPS (DN100). Use 4-inch NPS (DN100) for larger drainage piping unless larger cleanout is indicated.
- B. Locate at each change in direction of piping greater than 135 degrees.
- C. Locate at minimum intervals of 100 feet (15 m).
- D. Locate at base of each vertical soil and waste stack.

Install cleanout deck plates, of types indicated, with top flush with finished floor, for floor cleanouts for piping below floors.

Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor or as indicated. Size outlets as indicated.

Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

- A. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
- B. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to one percent slope.
- C. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.

Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

Install interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

- A. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
- B. Flush with Floor Installation: Set unit and extension if required, with cover flush with finished floor.
- C. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with extension sleeve and receiver housing cover flush with finished floor.
- D. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

Fasten recessed, wall-mounting plumbing specialties to reinforcement built into walls.

Secure supplies to supports or substrate.

Install individual stop valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated.

Install water-supply stop valves in accessible locations.

Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

Locate drainage piping as close as possible to bottom of floor slab supporting fixtures and drains, unless indicated otherwise.

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.

Include wood-blocking reinforcement for recessed and wall-mounting plumbing specialties.

CONNECTIONS

Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

- A. Install piping connections between plumbing specialties and piping specified in other Division 22 Sections.
- B. Install piping connections indicated between appliances and equipment specified in other Sections; connect directly to plumbing piping systems.
- C. Install piping connections indicated as indirect wastes from appliances and equipment specified in other Sections, to spill over receptors connected to plumbing piping systems.

Install hoses between plumbing specialties and appliances as required for connections.

Arrange for electric-power connections to plumbing specialties and devices that require power. Electric power is specified in Division 26 Sections.

Drainage Runouts to Plumbing Specialties: Install drainage and vent piping, with approved trap, of sizes indicated, but not smaller than required by authorities having jurisdiction.

Interceptor Connections: Connect piping, flow-control fittings, and accessories as indicated.

- A. Grease Interceptors: Connect inlet and outlet to unit, and flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic draw-off-type unit.
- B. Solids Interceptors: Connect inlet and outlet.

Ground electric-powered plumbing specialties.

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

Arrange for electric-power connections to plumbing specialties and devices that require power. Electric power, wiring, and disconnect switches are specified in Division 26 Sections.

FLASHING INSTALLATION

Fabricate flashing manufactured from single piece unless large pans, sumps, or other drainage shapes are required.

Burn joints of lead sheets where required.

Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

- A. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (2500 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
- B. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
- C. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

Set flashing on floors and roofs in solid coating of bituminous cement.

Secure flashing into sleeve and specialty clamping ring or device.

Install flashing for piping passing through roofs with counter flashing or commercially made flashing fittings, according to Division 7 Section "Sheet Metal Flashing and Trim."

Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having caulking recess.

Fabricate and install flashing and pans, sumps, and other drainage shapes as indicated. Install drain connection if indicated.

FIELD QUALITY CONTROL

Manufacturer's Field Service: Provide services of factory-authorized service representative to supervise the field assembly of components and installation of grease recovery units, including piping and electrical connections, and to report results in writing.

- A. Test and adjust plumbing specialty controls and safeties. Replace damaged and malfunctioning controls and components.

COMMISSIONING

Before startup, perform the following checks:

- A. System tests are complete.
- B. Damaged and defective specialties and accessories have been replaced or repaired.
- C. Clear space is provided for servicing specialties.

Before operating systems, perform the following steps:

- A. Close drain valves, hydrants, and hose bibbs.
- B. Open general-duty valves to fully open position.
- C. Remove and clean strainers.
- D. Verify that drainage and vent piping are clear of obstructions. Flush with water until clear.

Adjust operation and correct deficiencies discovered during commissioning.

PROTECTION

Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

- A. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

22 14 16 STORM WATER PIPING

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes sanitary drainage and vent piping, and storm drainage piping inside building and to locations indicated.

Related Sections include the following:

- A. Division 33 Section "Sewerage and Drainage" for sanitary sewerage and storm drainage.
- B. Division 33 Section "Foundation Drainage Systems" for foundation drains.
- C. Division 22 Section "Plumbing Specialties" for drainage and vent piping system specialties.

DEFINITIONS:

Sewerage Piping: Building sewer piping outside building that conveys sanitary sewage from building.

Storm Drainage Piping: Building sewer piping outside building that conveys storm drainage from building.

Service Entrance Piping: Drainage piping at entry into building between outside building sewer piping and inside drainage piping.

Drainage and Vent Piping: Piping inside building that conveys waste water and vapors from fixtures and equipment throughout the building.

The following are industry abbreviations for plastic and other piping materials:

- A. ABS: Acrylonitrile-butadiene-styrene.
- B. EPDM: Ethylene-propylene-diene polymer, rubber.
- C. NBR: Acrylonitrile-butadiene rubber.
- D. PVC: Polyvinyl chloride.

SYSTEM PERFORMANCE REQUIREMENTS:

Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

- A. Soil, Waste, and Vent Systems: 10-foot head of water (30 kPa).
- B. Storm Drainage Systems: 10-foot head of water (30 kPa).

SUBMITTALS:

Test Results and Reports: Specified in "Field Quality Control" Article.

QUALITY ASSURANCE:

Provide listing/approval stamp, label, or other marking on piping made to specified standards.

Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

All cast iron soil pipe and fittings shall be marked with a collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

PART 2 PRODUCTS

PIPES AND TUBES:

General: Applications of the following pipe and tube materials are indicated in Part 3 "Piping Applications" Article.

Hub-and-Spigot, Cast-Iron Soil Pipe: ASTM A 74, Service and Extra Heavy classes. Include ASTM C 564 rubber gasket, with dimensions required for pipe class, for each hub.

Hubless, Cast-Iron Soil Pipe: ASTM A 888 or CISPI Standard 301.

PVC Plastic Pipe: ASTM D2665, Schedule 40.

PIPE AND TUBE FITTINGS:

General: Applications of the following pipe and tube fitting materials are indicated in Part 3 "Piping Applications" Article.

Threaded-Fitting, End Connections: ASME B1.20.1.

Hub-and-Spigot, Cast-Iron, Soil-Pipe Fittings: ASTM A 74, Service and Extra Heavy classes, hub and spigot. Include ASTM C 564 rubber gasket, with dimensions required for pipe class, for each hub.

Hubless, Cast-Iron, Soil-Pipe Fittings: CISPI Standard 301.

Cast-Iron, Solvent Fittings: ASME B16.45 drainage-pattern aerator and dearator.

Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal stock body with ball and socket joint, metal to metal bronze seating surfaces, and female threaded ends with threads according to ASME B1.20.1.

Cast-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.

Cast-Iron, Threaded Drainage Fittings: ASME B16.12, galvanized, recessed, drainage pattern.

Cast-Iron, Threaded Flanges: ASME B16.1, Class 125.

PVC Socket Fittings: ASTM D2665, made to ASTM D3311 drain, waste and vent pipe patterns.

PVC Plastic, Tubular Fittings: ASTM F409 drainage pattern, with ends as required for application.

JOINING MATERIALS:

General: Applications of the following piping joining materials are indicated in Part 3 "Piping Applications" Article.

Refer to Division 22 Section "Basic Mechanical Materials and Methods" for commonly used joining materials.

Hubless, Cast-Iron, Soil-Piping Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve or gasket with integral, center pipe stop. Include the following:

- A. Heavy-Duty, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel housing or shield; and stainless-steel clamps. Include gasket.
 - 1. Clamp Width: 3 inches (75 mm) wide with 4 clamps, for piping 1-1/2- to 4-inch NPS (DN40 to DN100).
 - 2. Clamp Width: 4 inches (100 mm) wide with 6 clamps, for piping 5- to 10-inch NPS (DN125 to DN250).

Transition Couplings: Coupling or other manufactured fitting same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

Flexible, Transition Couplings for Underground, Non-pressure Piping: ASTM C1173 with elastomeric sleeve. Include ends same sizes as piping to be joined and include corrosion-resistant metal band on each end.

Sleeve Type for Plain-End Piping: Rubber or elastomeric sleeve and stainless-steel band assembly, fabricated to match outside diameters of piping to be joined. Include the following:

- A. Sleeves for Cast-Iron Soil Piping: ASTM C564 rubber.
- B. Sleeves for Plastic Piping: ASTM F477 elastomeric seal.
- C. Sleeves for Dissimilar Piping: Compatible with piping materials to be joined.
- D. Bands: Stainless-steel, one at each pipe insert.

Gasket Type for Dissimilar-End Piping: Rubber or elastomeric compression gasket, made to match inside diameter of pipe or hub, and outside diameter of adjoining pipe. Include the following:

- A. Gaskets for Cast-Iron Piping: ASTM C564 rubber.
- B. Gaskets for Plastic Piping: ASTM F477 elastomeric seal.
- C. Gaskets for Dissimilar Piping: Compatible with piping materials to be joined.

VALVES:

Refer to Division 22 Section "Valves" for general-duty valves. Use valves specified for "Domestic Water Systems" applications.

PART 3 EXECUTION

EXCAVATION:

Refer to Division 33 Section "Earthwork" for excavating, trenching, and backfilling.

PIPING APPLICATIONS:

Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

Flanges may be used on aboveground piping, unless otherwise indicated.

Underground Storm Drainage Piping: Use the following:

- A. 1-1/2" through 12" NPS (DN40 to DN300): PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
- B. 2" through 10" NPS (DN50 to DN250): Hub and spigot, cast-iron soil pipe, service class; hub and spigot, cast-iron, soil pipe fittings, service class; and compression joints.
- C. 12" through 15" NPS (DN300 to DN375): Hub and spigot, cast-iron soil pipe, extra heavy class; hub and spigot, cast-iron, soil pipe fittings, extra heavy class; and compression joints.

Aboveground Storm Drainage Piping: Use the following:

- A. 1-1/2" through 10" NPS (DN40 to DN200): Hubless, cast-iron soil pipe; hubless, cast-iron, soil-pipe fittings; and heavy-duty, Type 304, stainless steel hubless, cast-iron, soil-piping couplings.

PIPING INSTALLATION, GENERAL:

Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping installation.

SERVICE ENTRANCE PIPING INSTALLATION:

Refer to Division 33 Section for storm sewer piping.

Extend building sanitary drain piping and connect to sanitary sewer piping in sizes and locations indicated for service entrances into building. Install cleanout and extension to grade at connections of building sanitary drains with building sanitary sewers.

Extend building storm drain piping and connect to storm sewer piping in sizes and locations indicated for service entrances into building. Install cleanout and extension to grade at connections of building storm drains and building storm sewers.

Extend building storm drain, forced-main piping and connect to storm sewer piping in size and location indicated for service entrance into building. Install cleanout, fitting with closure plug or equivalent, inside building.

Install sleeve with water stop and mechanical sleeve seal at each service entrance pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.

PIPING INSTALLATION:

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."

Make changes in direction for 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 make change in direction of flow greater than 90 degrees. Use proper size of standard increasers and reducers if different sizes of piping are connected. Reducing size of drainage piping in direction of flow is prohibited.

Lay buried building drain 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.

Install drainage and vent piping at the following minimum slopes, unless otherwise indicated:

- A. Storm Building Drain: 1 percent downward in direction of flow.
- B. Horizontal, Storm Drainage Piping: 1 percent downward in direction of flow.

Sleeves are not required for cast-iron soil piping passing through concrete slab on grade if slab is without membrane waterproofing.

Install PVC plastic drainage piping according to ASTM D2665.

Install underground PVC plastic drainage piping according to ASTM D2321.

JOINT CONSTRUCTION:

Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

- A. Compression Joints: Make with rubber gasket matching class of pipe and fittings.
- B. Hubless Joints: Make with rubber gasket and sleeve or clamp.

Grooved Joints: Assemble joints with coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's instructions.

PVC Piping Joints: Join drainage piping according to ASTM D2665.

Handling of Solvent Cements, Primers, and Cleaners: Comply with procedures in ASTM F402 for safe handling during joining of plastic pipe and fittings.

VALVE INSTALLATION:

Shutoff Valves: Install shutoff valve on each pump discharge and where indicated. Use gate or ball valves for piping 2" NPS (DN50) and smaller. Use gate or butterfly valves for piping 2-1/2" NPS (DN65) and larger.

Check Valves: Install swing check valve on each pump discharge, downstream from shutoff valve.

HANGER AND SUPPORT INSTALLATION:

Refer to Division 22 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:

- A. Riser clamps, MSS Type 8 or Type 42, for vertical runs.
- B. Adjustable steel clevis hangers, MSS Type 1, for individual, straight, horizontal runs 100 feet (30 m) and less.
- C. Adjustable roller hangers, MSS Type 43, for individual, straight, horizontal runs longer than 100 feet (30 m).
- D. Spring cushion rolls, MSS Type 49, if indicated, for individual, straight, horizontal runs longer than 100 feet (30 m).

- E. Pipe rolls, MSS Type 44, for multiple, straight, horizontal runs 100 feet (30 m) or longer. Support pipe rolls on trapeze.
- F. Spring hangers, MSS Type 52, for supporting base of vertical runs.

Install supports according to Division 22 Section "Hangers and Supports."

Support vertical piping and tubing at base and at each floor.

Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

Install hanger for PVC plastic piping with the following maximum spacing:

- A. 8" NPS (DN200) and Smaller: Maximum horizontal spacing, 48 inches (1200 mm); maximum vertical spacing, 10 feet (3 m).

Install hangers for cast-iron soil piping with the following maximum spacing:

- A. 1-1/2" through 15" NPS (DN40 to DN375): Maximum horizontal spacing, 60 inches (1500 mm); maximum vertical spacing, 15 feet (4.5 m).

Minimum rod size to be according to manufacturer's written instructions for service conditions based on maximum hanger spacing.

Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

CONNECTIONS:

Connect service entrance piping to exterior sewerage and drainage piping. Use transition fitting to join dissimilar piping materials.

Connect drainage piping to service entrance piping, and extend to and connect to the following:

- A. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Specialties."
- B. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections 2-1/2-inch NPS (DN65) and larger.

FIELD QUALITY CONTROL:

Inspect piping as follows:

- A. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- B. 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 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.
- C. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- D. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

Test piping according to procedures of authorities having jurisdiction or, in absence of published procedure, as follows:

- A. 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.
- B. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
- C. 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 feet of head (30 kPa). Water level must not drop for 12 hour duration of test. Inspect joints for leaks.
- D. 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 (250 Pa). 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.
- E. Repair leaks and defects using new materials and retest piping or portion thereof until satisfactory results are obtained.
- F. Prepare reports for tests and required corrective action.

Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedure, as follows:

- A. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
- B. Cap and subject piping to static-water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for 12 hours. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Repair leaks and defects using new materials and retest piping or portion thereof until satisfactory results are obtained.
- E. Prepare reports for tests and required corrective action.

CLEANING AND PROTECTING:

Clean interior of piping system. Remove dirt and debris as work progresses.

Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

Place plugs in ends of uncompleted piping at end of day and when work stops.

Exposed PVC Piping: Protect plumbing vents exposed to sunlight with 2 coats of water-based latex paint.

END OF SECTION

22 14 23 STORM DRAINAGE SPECIALTIES

PART 1 GENERAL**RELATED DOCUMENTS**

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

SUMMARY

This Section includes plumbing specialties for the following:

- A. Water distribution systems.
- B. Soil, waste, and vent systems.
- C. Storm drainage systems.

Related Sections include the following:

- A. Division 22 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, basic installation requirements, and labeling and identifying requirements; and escutcheons, dielectric fittings, sleeves, and sleeve seals that are not in this Section.
- B. Division 22 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.
- C. Division 22 Section "Meters and Gages" for thermometers, pressure gages, fittings, and water meters.
- D. Division 22 Section "Water Distribution Piping" for water-supply piping and connections.
- E. Division 22 Section "Drainage and Vent Piping" for drainage and vent piping and connections.

SYSTEM PERFORMANCE REQUIREMENTS

Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

- A. Storm Drainage Piping: 10-foot head of water (30 kPa).
- B. Force-Main Piping: 100 psig (690 kPa).

SUBMITTALS

Product Data: For each plumbing specialty indicated. Include rated capacities of selected equipment and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following plumbing specialty products:

- A. Cleanouts.
- B. Roof drains.
- C. Sleeve penetration systems.

Reports: Specified in "Field Quality Control" Article.

QUALITY ASSURANCE

Product Options: Drawings indicate size, profiles, dimensional requirements, and characteristics of plumbing specialties and are based on the specific types and models indicated. Other manufacturers'

products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

Provide listing/approval stamp, label, or other marking on plumbing specialties made to specified standards.

Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

Comply with NFPA 70, "National Electrical Code," for electrical components.

Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic potable-water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.

PART 2 PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Sleeve Penetration Systems:
 - 1. Calpico, Inc.
 - 2. Thunderline Corp.

BACKWATER VALVES

Horizontal Backwater Valves: ASME A112.14.1, cast-iron body, with removable bronze swing-check valve and threaded or bolted cover.

- A. Closed-Position Check Valve: Factory assembled or field modified to hang closed unless subject to backflow condition.
- B. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor, instead of cover.

Drain Outlet Backwater Valves: Cast-iron or bronze body, with removable ball float, threaded inlet, and threaded or spigot outlet.

MISCELLANEOUS PIPING SPECIALTIES

Roof Flashing Assemblies: Manufactured assembly made of 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch- (1.6-mm-) thick, lead flashing collar and skirt extending at least 8 inches (200 mm) from pipe with galvanized steel boot reinforcement, and counterflashing fitting.

- A. Vent Cap: Open top, without cap.

Downspout Nozzles: Cast-bronze body with threaded inlet for pipe size indicated, and cast-bronze wall flange with mounting holes.

- A. Finish: Polished bronze.

SLEEVE PENETRATION SYSTEMS

Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.

Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.

Stack Fitting: ASTM A 48, cast-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and cast-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.

- A. Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical waste and vent stacks.

FLASHING MATERIALS

Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

- A. General Use: 4 lb/sq. ft. or 0.0625-inch thickness (20 kg/sq. m or 1.6-mm thickness).
- B. Vent Pipe Flashing: 3 lb/sq. ft. or 0.0469-inch thickness (15 kg/sq. m or 1.2-mm thickness).
- C. Burning: 6 lb/sq. ft. or 0.0937-inch thickness (30 kg/sq. m or 2.4-mm thickness).

Zinc-Coated Steel Sheet: ASTM A 653 (ASTM A 653M), with 0.20 percent copper content and 0.04-inch (1.016-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1-mm) minimum thickness.

Fasteners: Metal compatible with material and substrate being fastened.

Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

CLEANOUTS

Cleanouts (C.O.): Where plumbing specialties of this designation are indicated, provide products complying with the following:

- A. Applicable Standard: ASME A112.36.2M.
- B. Products: Subject to compliance with requirements, provide products equal to the following:
 - 1. Finished Walls: Zurn Z1446-BP bronze plug with stainless steel wall access cover.
 - 2. Finished Floors: Zurn ZB1400 adjustable floor level cleanout with polished bronze scoriated top flush with floor.
 - 3. Carpeted Floor: Zurn ZB1400-CM adjustable floor level cleanout with polished bronze top and carpet retainer.
 - 4. Outside Building: Zurn Z1402 cast iron cleanout extension with bronze plug set in cast iron meter box with cover. Cleanout plug 6" below cover set in concrete.
- C. Body or Ferrule Material: Cast iron.
- D. Clamping Device: Required.
- E. Outlet Connection: Threaded.
- F. Closure: Brass plug with straight threads and gasket.
- G. Adjustable Housing Material: Cast iron with threads.
- H. Frame and Cover Shape: Round.
- I. Acceptable Manufacturer's:

1. Zurn Industries, Inc., Hydromechanics Div.
2. Josam Co.
3. Smith: Jay R. Smith Mfg. Co.
4. Tyler Pipe, Wade Div.
5. Watts Industries, Inc., Ancon Drain Div.

ROOF DRAINS

Roof Drain X"-RD: Where plumbing specialties of this designation are indicated, provide products complying with the following:

- A. Applicable Standard: ASME A112.21.2M.
- B. Products: Subject to compliance with requirements, provide products equal to the following:
 1. Model: Zurn Z-100.
 2. Body Material: Cast iron.
 3. Dimensions of Body: See plans.
 4. Combination Flashing Ring and Gravel Stop: Required.
 5. Outlet: Bottom.
 6. Dome Material: Cast iron, bronze in storm shelter locations.
 7. Extension Collars: Required on overflow drains.
 8. Underdeck Clamp: Required.
 9. Sump Receiver: Required.
- C. Acceptable Manufacturer's:
 1. Zurn Industries, Inc., Hydromechanics Div.
 2. Josam Co.
 3. Smith: Jay R. Smith Mfg. Co.
 4. Tyler Pipe, Wade Div.
 5. Watts Industries, Inc., Ancon Drain Div.

PART 3 EXECUTION

PLUMBING SPECIALTY INSTALLATION

General: Install plumbing specialty components, connections, and devices according to manufacturer's written instructions.

Install backwater valves in building drain piping as indicated. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

Install expansion joints on vertical risers, stacks, and conductors as indicated.

Install cleanouts in aboveground piping and building drain piping as indicated, and according to Code, according to the following:

- A. Size same as drainage piping up to 4-inch NPS (DN100). Use 4-inch NPS (DN100) for larger drainage piping unless larger cleanout is indicated.
- B. Locate at each change in direction of piping greater than 135 degrees.
- C. Locate at minimum intervals of 100 feet (15 m).
- D. Locate at base of each vertical soil and waste stack.

Install cleanout deck plates, of types indicated, with top flush with finished floor, for floor cleanouts for piping below floors.

Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Size outlets as indicated.

Install roof-drain flashing collar or flange so no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.

Locate drainage piping as close as possible to bottom of floor slab supporting fixtures and drains, unless indicated otherwise.

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.

Include wood-blocking reinforcement for recessed and wall-mounting plumbing specialties.

CONNECTIONS

Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

Drainage Runouts to Plumbing Specialties: Install drainage and vent piping of sizes indicated, but not smaller than required by authorities having jurisdiction.

FLASHING INSTALLATION

Fabricate flashing manufactured from single piece unless large pans, sumps, or other drainage shapes are required.

Burn joints of lead sheets where required.

Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

- A. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (2500 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
- B. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
- C. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

Set flashing on floors and roofs in solid coating of bituminous cement.

Secure flashing into sleeve and specialty clamping ring or device.

Install flashing for piping passing through roofs with counter-flashing or commercially made flashing fittings, according to Division 7 Section "Sheet Metal Flashing and Trim."

Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having caulking recess.

Fabricate and install flashing and pans, sumps, and other drainage shapes as indicated. Install drain connection if indicated.

FIELD QUALITY CONTROL

Manufacturer's Field Service: Provide services of factory-authorized service representative to supervise the field assembly of components and installation of grease recovery units, including piping and electrical connections, and to report results in writing.

- A. Test and adjust plumbing specialty controls and safeties. Replace damaged and malfunctioning controls and components.

PROTECTION

Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

- A. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

22 40 00 PLUMBING FIXTURES

PART 1 GENERAL**RELATED DOCUMENTS**

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

SUMMARY

This Section includes plumbing fixtures and trim, faucets, other fittings, and related components.

Related Sections: The following Sections contain requirements that relate to this Section:

- A. Division 7 Section "Joint Sealants" for sealing between fixtures and walls, floors, and counters.
- B. Division 22 Section "Valves" for general-duty valves used as supply stops.
- C. Division 22 Section "Plumbing Specialties" for backflow preventers and other specialties not specified in this Section.

DEFINITIONS

Accessible: Plumbing fixture, building, facility, or portion thereof that can be approached, entered, and used by physically handicapped, disabled, and elderly people.

Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, traps and waste pipes. Pipe fittings, tube fittings, and general-duty valves are included where indicated.

SUBMITTALS

General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

Product Data for each plumbing fixture category and type specified. Include selected fixture, trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

Wiring diagrams from manufacturer for electrically operated units.

Maintenance data for plumbing fixtures and components to include in the operation and maintenance manuals specified in Division 1.

QUALITY ASSURANCE

Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category from one source and by a single manufacturer.

Energy Policy Act Requirements: Comply with requirements of all Federal and Public Laws regarding water flow rate and water consumption of plumbing fixtures.

Listing and Labeling: Provide electrically operated fixtures and components specified in this Section that are listed and labeled.

DELIVERY, STORAGE, AND HANDLING

Deliver plumbing fixtures in manufacturer's protective packing, crating, and covering.

Store plumbing fixtures on elevated platforms in dry location.

PROJECT CONDITIONS

Field Measurements: Coordinate roughing-in and final fixture locations and verify that plumbing fixtures can be installed to comply with original design and referenced standards.

PART 2 PRODUCTS

PLUMBING FIXTURE STANDARDS

Comply with applicable standards below and other requirements specified.

- A. Electric Water Coolers: ARI 1010 and UL 399.
- B. Emergency Equipment: ANSI Z358.1.
- C. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
- D. Porcelain-Enameled Fixtures: ASME A112.19.4M.
- E. Semivitreous Ceramic Fixtures: ASME A112.19.9M.
- F. Stainless-Steel Fixtures Other than Service Sinks: ASME A112.19.3M.
- G. Vitreous-China Fixtures: ASME A112.19.2M.
- H. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
- I. Water-Closet, Flushometer Tank Trim: ASSE 1037.

LAVATORY/SINK FAUCET STANDARDS

Comply with ASME A112.18.1M and other requirements specified for lavatory, sink, and similar-type-fixture faucet fittings. Include hot- and cold-water indicators; 2.5-gpm- (0.16-L/s-) maximum flow rate; and polished, chrome-plated finish; except where otherwise indicated. Coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.

- A. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
- B. Faucet Hose: ASTM D 3901.
- C. Hose-Connection Vacuum Breakers: ASSE 1011.
- D. Hose-Coupling Threads: ASME B1.20.7.
- E. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
- F. Pipe Threads: ASME B1.20.1.
- G. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
- H. Sink Spray Hoses: ASTM D 3573.
- I. Thermostatic mixing valves: ASSE 1070.

MISCELLANEOUS FITTING STANDARDS

Comply with ASME A112.18.1M and other requirements specified for fittings, other than faucets. Include polished, chrome-plated finish, except where otherwise indicated. Coordinate fittings with other components and connectors.

- A. Atmospheric Vacuum Breakers: ASSE 1001.

- B. Automatic Flow Restrictors: ASSE 1028.
- C. Brass and Copper, Supplies and Tubular Brass: ASME A112.18.1M.
- D. Fixed Flow Restrictors: ASSE 1034.
- E. Manual-Operation Flushometers: ASSE 1037.
- F. Plastic Tubular Fittings: ASTM F 409.
- G. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

MISCELLANEOUS COMPONENT STANDARDS

Comply with applicable standards below and other requirements specified for components for plumbing fixtures, equipment, and appliances.

- A. Disposers: ASSE 1008 and UL 430.
- B. Floor Drains: ASME A112.21.1M.
- C. Hose-Coupling Threads: ASME B1.20.7.
- D. Pipe Threads: ASME B1.20.1.
- E. Supply and Drain Insulation Kits: CABO A117.1.
- F. Supports: ASME A112.6.1M.

FITTINGS

Fittings for Plumbing Fixtures: Refer to plumbing fixture schedules at the end of this Section for materials for supplies, supply stops, supply risers, traps, and other fittings.

Fittings for Equipment Specified in Other Sections: Fittings include the following:

- A. Supply Inlets: Copper tube, size required for final connection.
- B. Supply Stops: Chrome-plated brass, angle or straight; compression type; same size as supply inlet and with outlet matching supply riser; loose-key type in exposed installations; wheel-handle type in concealed installations.
- C. Supply Risers: 3/8-inch NPS (DN10) flexible copper tube with knob end and chrome-plated tube.
- D. Traps: Tubular brass with 0.045-inch (1.1 mm) wall thickness, slip-joint inlet, cleanout, wall flange, escutcheons, and size to match equipment. Use chrome-plated tube for exposed applications.
- E. Continuous Waste: Tubular brass, 0.045-inch (1.1-mm) wall thickness, with slip-joint inlet, and size to match equipment.
- F. Indirect Waste: Tubular brass, 0.045-inch (1.1-mm) wall thickness, and size to match equipment.

FIXTURE SCHEDULE

- P-1** Water Closet - Kohler K-4325 - Olsonite #95 white elongated open front seat – Sloan 8111 battery operated flush valve – Zurn chair carrier - Rim height: 15 inches, (Seat height 17 to 19 inches on handicap fixtures designated with a "★").
- P-2** Lavatory – Kohler K-2005 - wall hung - vitreous china - 18" x 17" – Sloan SF-2350 sensor battery operated faucet - flat strainer drain - supplies with loose key stops - C.P. P-trap - Zurn concealed arm chair carrier – ASSE 1070 thermostatic mixing valve - Rim height: 32 inches floor to rim top, (34 inches to rim top on handicap fixtures designated with a "★").
- P-3** Sink - Just SL-ADA-2019-16-A-GR single compartment - 14"x16"x6.5" bowl I.D. - one (1) hole punch - 16 gage - J35-316 strainer - C.P. P-traps - supplies with loose key stops – Zurn

Z812A1-XL faucet – 5-3/8" gooseneck spout – 3F – aerator – lever handles. single lever handles – ASSE 1070 thermostatic mixing valve.

P-4 Ice Maker Box - Guy Gray model SSIB1AB - 10"x8-3/4"x3-1/2" I.D. - 1/2" FIP inlet - 1/4" compression angle outlet.

P-5 Mop sink - Williams HL-1800 - 24"x 24" x 12" - Terrazzo with molded-in stainless steel cap - 3 drain cast integral with nickel bronze strainer and cast brass waste – Chicago 540-LD89SWXABCP faucet - wall brace and pail hook - BP splash catcher panels of 20 ga. type 304 stainless steel – 36" hose – stainless steel mop hanger 24" long with 3 rubber grips.

P-6 Electric water cooler Bi-level – Halsey Taylor HTHB-HAC8BL with HYDROBOOST bottle filling station – ADA - (4) touch pads touch pads - wall mounted - Zurn chair carrier - stainless steel cabinet - flow regulator - hermetically sealed compressor - 1/5 h.p., 115/1/60 compressor with five year warranty on refrigeration and water cycle - cane bezel - P-trap and loose key stops - lead free - Mounting height: High spout 42" A.F.F. – low spout 34" A.F.F..

P-7 Wall Hydrant - Woodford model B67 - backflow preventer - non-freeze - automatic draining - bronze construction - keyed handle.

P-8 Sink - Just DL-ADA-2133-A-GR - double compartment - 14"x16"x6.5" bowl I.D. - four (4) hole punch - 18 gauge - J35-316 strainer - C.P. P-traps - supplies with stops - Chicago model 2301-8E34ABCP faucet with spray - 1/2" disposer - ASSE 1070 thermostatic mixing valve.

P-9 Sink - Just SLXD-ADA-2133-A-GR - double compartment - 16"x28"x12" bowl I.D. - four (4) hole punch - 18 gauge - J35-316 strainer - C.P. P-traps - supplies with stops - Chicago model 2301-8E34ABCP faucet with spray –ASSE 1070 thermostatic mixing valve.

P-10 Emergency Eyewash - Guardian model G1806 (LH/RH) - 90° swivel - self-regulating flow control - integral filter in head - float-off dust covers - deck mounted - verify left or right hand mounting.

Products: Subject to compliance with requirements, provide one of the following manufacturers:

A. Vitreous-China Water Closet, Urinal and Lavatory:

1. American Standard, Inc.
2. Eljer Industries.
3. Kohler Co.
4. Sloan.
5. Zurn.

B. Flushometer Valve:

1. Sloan Valve Co. (Regal-Pro).
2. Zurn Industries, Inc.; Flush Valve Operations.

C. Toilet Seat:

1. Bemis Mfg. Co.
2. Centoco Manufacturing Corp.
3. Church Seat Co.
4. Olsonite Co.

D. Faucet:

1. Chicago Faucet Co.
2. T&S Brass and Bronze Works Inc.

3. Zurn Aquaspec
 4. Delta, Cambridge Brass.
 5. Sloan.
- E. Fitting Insulation Kit: TRUEBRO, Inc. model #102.
- F. Stainless-Steel Sink:
1. Elkay Manufacturing Co.
 2. Just Manufacturing Co.
- G. Disposer:
1. Emerson Electric Co.; In-Sink-Erator Div.
 2. General Electric Co.; GE Answer Center.
 3. Kitchen Aid, Inc.
 4. Waste King, Inc.
- H. Emergency Fixtures:
1. Acorn.
 2. Bradley.
 3. Chicago Faucets.
 4. Guardian.
 5. T&S Brass.
 6. Haws.
- I. Drinking Fountains:
1. Halsey Taylor.
 2. Elkay.
 3. Haws.
 4. Oasis.
- H. Terrazzo Mop-Service Basin:
1. Fiat Products, Inc.
 2. Stern-Williams Co., Inc.

PART 3 EXECUTION

EXAMINATION

Examine roughing-in for potable, hot- and cold-water supply piping systems; soil, waste, and vent piping systems; and supports. Verify that locations and sizes of piping and locations and types of supports match those indicated, before installing and connecting fixtures. Use manufacturer's roughing-in data when roughing-in data are not indicated.

Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

Do not proceed until unsatisfactory conditions have been corrected.

APPLICATIONS

Include supports for plumbing fixtures according to the following:

- A. Carriers: For wall-hanging water closets and fixtures supported from wall construction.
- B. Chair Carriers: For wall-hanging urinals, lavatories, sinks, drinking fountains, and electric water coolers.

- C. Reinforcement: For floor-mounted lavatories and sinks that require securing to wall and recessed, box-mounted, electric water coolers.
 - 1. Fabricate reinforcement from 2-by-4-inch or 2-by-6-inch (38-by-89-mm or 38-by-140-mm) fire-retardant-treated-wood blocking between studs or 1/4-by-6-inch (6.35-by-152.4-mm) steel plates attached to studs, in wall construction, to secure fixtures to wall. Include length that will extend beyond ends of fixture mounting bracket and attach to at least 2 studs.
- D. Include fitting insulation kits for accessible fixtures according to the following:
 - 1. Cover hot- and cold-water supplies, stops and handles, drain, trap, and waste to wall. Insulation kit to be equal to Truebro model #102.

PLUMBING FIXTURE INSTALLATION

Assemble plumbing fixtures and trim, fittings, faucets, and other components according to manufacturers' written instructions.

Install fixtures level and plumb according to manufacturers' written instructions, roughing-in drawings, and referenced standards.

Install floor-mounted, floor-outlet water closets with closet flanges and gasket seals.

Install floor-mounted, back-outlet water closets with fittings and gasket seals.

Install wall-hanging, back-outlet water closets with support manufacturer's tiling frame or setting gage.

Install toilet seats on water closets.

Install wall-hanging, back-outlet urinals with gasket seals.

Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for handicapped people to reach.

Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate.

Fasten floor-mounted fixtures to substrate. Fasten fixtures having holes for securing fixture to wall construction, to reinforcement built into walls.

Fasten recessed, wall-mounted fittings to reinforcement built into walls.

Fasten counter-mounting plumbing fixtures to casework.

Secure supplies to supports or substrate within pipe space behind fixture.

Set shower receptors and mop basins in leveling bed of cement grout.

Install individual stop valve in each water supply to fixture. Use gate or globe valve where specific stop valve is not specified.

- A. Exception: Omit stop valves on supplies to emergency equipment, except when permitted by authorities having jurisdiction. When permitted, install valve chained and locked in OPEN position.

Install water-supply stop valves in accessible locations.

Install faucet, laminar-flow fittings with specified flow rates and patterns in faucet spouts when faucets are not available with required rates and patterns. Include adapters when required.

Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts when faucets are not available with required rates and patterns. Include adapters when required.

Install shower, flow-control fittings with specified maximum flow rates in shower arms.

Install traps on fixture outlets. Omit traps on fixtures having integral traps. Omit traps on indirect wastes, except where otherwise indicated.

Install disposers in sink outlets. Electrical Contractor to install switch where indicated, or in wall adjacent to sink if location is not indicated.

Install hot-water dispensers in back top surface of sink or in counter with spout over sink.

Install escutcheons at wall, floor, and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons where required to conceal protruding pipe fittings.

Seal joints between fixtures and walls, floors, and counters using sanitary-type, 1-part, mildew-resistant, silicone sealant according to sealing requirements specified in Division 7 Section "Joint Sealants." Match sealant color to fixture color.

CONNECTIONS

Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

- A. Install piping connections between plumbing fixtures and piping systems and plumbing equipment specified in other Division 15 Sections.

Supply and Waste Connections to Plumbing Fixtures: Refer to plumbing fixture schedules at the end of this Section for fitting sizes and connection requirements for each plumbing fixture.

Supply and Waste Connections to Equipment Specified in Other Sections: Connect equipment with supply inlets, supply stops, supply risers, and traps specified in this Section. Use fitting sizes required to match connected equipment. Connect fittings to plumbing piping.

Ground equipment.

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

Arrange for electric-power connections to fixtures and devices that require power. Electric power is specified in Division 16 Sections.

FIELD QUALITY CONTROL

Verify that installed fixtures are categories and types specified for locations where installed.

Check that fixtures are complete with trim, faucets, fittings, and other specified components.

Inspect installed fixtures for damage. Replace damaged fixtures and components.

Test installed fixtures after water systems are pressurized and demonstrate proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

ADJUSTING AND CLEANING

Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

Operate and adjust disposers, hot-water dispensers, and controls. Replace damaged and malfunctioning units and controls.

Adjust water pressure at drinking fountains, electric water coolers, faucets, shower valves, and flushometer valves having controls, to produce proper flow and stream.

Replace washers and seals of leaking and dripping faucets and stops.

Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Include the following:

- A. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
- B. Remove sediment and debris from drains.

PROTECTION

Provide protective covering for installed fixtures and fittings.

Do not allow use of fixtures for temporary facilities, except when approved in writing by Owner.

END OF SECTION

23 05 05 MECHANICAL GENERAL PROVISIONS

PART 1 GENERAL**GENERAL INFORMATION:**

The General Requirements and Supplementary Conditions are part of this contract and govern work under this division.

Temporary heating and air conditioning shall be the responsibility of the General Contractor. If the Contractor uses the permanent heating or air conditioning systems for temporary heating or air conditioning, he will need to get extended warranties on all equipment in use and replace filters in all units once a week. The extended warranties and filter replacement will need to cover the period between when the systems are turned on to Final Acceptance of the building. This shall include boilers, pumps, FPVAV's and AHU's, Etc. At the time of final inspection, if it is found that the interior of ductwork is dirty beyond normal standards, the ductwork systems shall be cleaned at the Contractor's expense.

SCOPE OF WORK:

Work by Mechanical Contractor: Provide all mechanical systems indicated by the drawings, specified or as instructed otherwise. Unless specified otherwise, provide all labor, materials and equipment necessary to provide a complete and operational system.

Work by Electrical Contractor: Provide all line voltage wiring and install items of equipment furnished by the Mechanical, such as thermostats, remote control panels, etc.

Mechanical and Electrical Coordination: The Mechanical will provide to the Electrical all manufacturer's wiring diagrams and installation data and locate all equipment furnished to the Electrical.

Where work or materials are specified or shown on drawings to be performed by more than one Contractor, each such Contractor will be deemed to have figured the item and the Architect will determine who shall furnish the work and who shall submit the credit to the Owner.

Work by General Contractor: Provide all openings and chases with proper framing and reinforcing as required for Mechanical equipment.

Provide access panels or doors where required for mechanical systems.

Provide concrete pads for all base mounted mechanical equipment.

Provide all exterior and interior louvers per the sizes indicated in the Mechanical contract documents.

DEFINITIONS:

Contractor: The contractor performing work under this Division of the Specifications.

Provide: Contractor is responsible to furnish and install component completely.

QUALITY ASSURANCE:

Manufacturers: Acceptable manufacturers are listed in applicable sections of the Specifications and on the drawings.

Drawings and Specifications are complimentary. Requirements indicated in either are binding and the most stringent is to be used.

The Contractor is to review documents for the work, and if any discrepancies occur between the work of this Division and the work of another Division, is to notify the Architect and obtain written instructions for any changes necessary. Any changes in the work by this Division made necessary by the failure or neglect of the Contractor to report such discrepancies will be made by, and at the expense of the Contractor.

Changes in Design or Installation: Refer to the General and Supplementary Conditions for requirements pertaining to changes in design and installation. Mechanical installation will otherwise be in accordance with the Contract Drawings and Specifications.

REGULATORY AGENCIES:

Permits and Fees: The Contractor is to pay for all permits and fees as required by Local or State regulatory agencies.

Codes: Work for this project is to comply with Federal, State and Local codes, ordinances and regulations. All work shall comply the latest adopted edition of the Building Code and associated sections of the National Fire Protection Association.

Work shall be done according to applicable codes in cases of conflict between specifications, plans and codes, except where plans and specifications call for higher standards than the codes.

SUBMITTALS AND SHOP DRAWINGS:

Submit product data and copies of shop drawings for all major pieces of equipment as indicated in the respective sections of this Division.

The intent of shop drawing submittals by the Contractor is to demonstrate to the Architect / Engineer that the Contractor understands the design concept and demonstrates his understanding by indicating and detailing the fabrication and installation methods to be used.

If deviations, discrepancies or conflicts between shop drawing submittals and Contract Documents are discovered either prior to or after shop drawing submittals are processed, the design drawings and specifications shall take precedence.

The Architect / Engineer shall review shop drawings for general conformance with the design concept of the project. The review shall not relieve the Contractor of the responsibility of compliance with the contract documents or errors in the shop drawings.

PRODUCT DELIVERY, STORAGE AND HANDLING:

Make provisions for the delivery and safe storage of all material and make the required arrangements with other trades to coordinate moving large pieces of equipment into the building.

Where materials are indicated to be "Furnished by Others" to the Contractor for installation, these materials shall be checked and their delivery properly receipted. After delivery the Contractor assumes all responsibility for the safekeeping of such equipment.

All materials stored outside are to be covered and protected with weatherproof material.

JOB CONDITIONS:

Verify existing site conditions and location prior to bidding.

Verify existing utilities and the actual location of in reference to location of such as shown on drawings. Any deviations between actual conditions and plan locations will be reviewed with the Architect. Repair, patch or terminate utilities encountered in an acceptable manner regardless of whether shown or not.

GUARANTEE:

The Contractor is to guarantee all materials, equipment, workmanship and operation of all systems for a period of one (1) year from the date of final acceptance of the entire project. Guarantee to repair or replace at Contractor's expense any art of the work which may be defective during that time provided that such defect is, in the opinion of the Architect / Engineer, due to imperfect material or workmanship and not to carelessness or improper use.

PART 2 PRODUCTS**STANDARDS FOR EQUIPMENT AND MATERIALS:**

All material shall be labeled UL, ETL, AGA or other approved independent testing authority. Air conditioning equipment shall be ARI certified.

All pressure rated vessels shall be provided with an ASME stamp, meeting the ASME Code or the Local Authority, whichever is most stringent.

All materials and equipment shall be of the best quality and be new, unused and without damage.

System design is based upon the first manufacturer listed in the Specifications and the other named manufacturers are considered equivalent. Any costs attributed in changes in ductwork, piping, plumbing, space clearances or other trades is to be borne by the Contractor when another manufacturer is used in lieu of the first listed.

MATERIALS OF APPROVED EQUAL:

Unless request for changes in base bid specifications are received and approved ten (10) days prior to the opening of bids, the successful Contractor will be held to furnish specified items under base bid.

PART 3 EXECUTION**PREPARATION:**

Base final installation of all materials and equipment on field dimensions and conditions at the building. The Mechanical Contractor is to inspect all work that affects the work of this Division and report any deficiencies to the General Contractor and Architect. No extra compensation will be allowed on account of minor differences in actual dimensions and those indicated on the plans.

INSTALLATION:

Workmanship: Perform all work in accordance with good commercial practice.

Supervision: The superintendent shall be responsible for the work of this Division and of all subcontractors under this Division. All questions or directions will be directed through the superintendent.

Installation Procedures:

- A. Field verify exact location, size, routing, elevation and accessibility of existing and new HVAC and plumbing systems.
- B. Properly size and locate all anchors, chases, recesses and openings required for the proper installation of the work.
- C. Piping and equipment located in areas subject to low temperatures shall be installed in a manner to prevent freezing.
- D. All equipment and materials are to be installed as high as possible.
- E. Install equipment and systems in accordance with manufacturer's recommends, accepted industry standards and all applicable Codes.
- F. Provide temporary filters in all air systems during construction. Install new clean filters prior to testing and balancing systems. Provide an extra set of filters to Owner at completion of project.

END OF SECTION

23 05 06 BASIC HVAC MATERIALS AND METHODS

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes the following basic mechanical materials and methods to complement other Division 23 Sections.

- A. Piping materials and installation instructions common to most piping systems.
- B. Concrete base construction requirements.
- C. Escutcheons.
- D. Dielectric fittings.
- E. Flexible connectors.
- F. Mechanical sleeve seals.
- G. Equipment nameplate data requirements.
- H. Labeling and identifying mechanical systems and equipment is specified in Division 23 Section "Identification for HVAC Piping and Equipment".
- I. Non-shrink grout for equipment installations.
- J. Field-fabricated metal and wood equipment supports.
- K. Installation requirements common to equipment specification sections.
- L. Mechanical demolition.
- M. Cutting and patching.
- N. Touchup painting and finishing.

Pipe and pipe fitting materials are specified in Division 23 piping system Sections.

DEFINITIONS:

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, crawl spaces, and tunnels.

Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

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.

The following are industry abbreviations for rubber materials:

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. EPDM: Ethylene propylene diene terpolymer rubber.

SUBMITTALS:

Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.

Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

Coordination Drawings: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:

- A. Planned piping layout, including valve and specialty locations and valve-stem movement.
- B. Clearances for installing and maintaining insulation.
- C. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
- D. Equipment and accessory service connections and support details.
- E. Exterior wall and foundation penetrations.
- F. Fire-rated wall and floor penetrations.
- G. Sizes and location of required concrete pads and bases.
- H. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
- I. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
- J. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.
- K. Access panel and door locations.

QUALITY ASSURANCE:

Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

DELIVERY, STORAGE, AND HANDLING:

Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

Protect flanges, fittings, and piping specialties from moisture and dirt.

SEQUENCING AND SCHEDULING:

Coordinate mechanical equipment installation with other building components.

Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors."

Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS**MANUFACTURERS:**

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Dielectric Unions:
 - 1. Capitol Manufacturing Co.
 - 2. Central Plastics Co.
 - 3. Eclipse, Inc.; Rockford-Eclipse Div.
 - 4. Epco Sales Inc.
 - 5. Hart Industries International, Inc.
 - 6. Watts Industries, Inc.; Water Products Div.
 - 7. Zurn Industries, Inc.; Wilkins Div.
- B. Dielectric Flanges:
 - 1. Capitol Manufacturing Co.
 - 2. Central Plastics Co.
 - 3. Epco Sales Inc.
 - 4. Watts Industries, Inc.; Water Products Div.
- C. Dielectric-Flange Insulating Kits:
 - 1. Calpico, Inc.
 - 2. Central Plastics Co.

- D. Dielectric Couplings:
 - 1. Calpico, Inc.
 - 2. Lochinvar Corp.
- E. Dielectric Nipples:
 - 1. Grinnell Corp.; Grinnell Supply Sales Co.
 - 2. Perfection Corp.
 - 3. Victaulic Co. of America.
- F. Metal, Flexible Connectors:
 - 1. ANAMET Industrial, Inc.
 - 2. Central Sprink, Inc.
 - 3. Flexicraft Industries.
 - 4. Flex-Weld, Inc.
 - 5. Grinnell Corp.; Grinnell Supply Sales Co.
 - 6. Hyspan Precision Products, Inc.
 - 7. McWane, Inc.; Tyler Pipe; Gustin-Bacon Div.
 - 8. Mercer Rubber Co.
 - 9. Metraflex Co.
 - 10. Proco Products, Inc.
 - 11. Uniflex, Inc.
 - 12. Flexonics.
- G. Mechanical Sleeve Seals:
 - 1. Calpico, Inc.
 - 2. Metraflex Co.
 - 3. Thunderline/Link-Seal.

PIPE AND PIPE FITTINGS:

Refer to individual Division 23 piping Sections for pipe and fitting materials and joining methods.

Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

JOINING MATERIALS:

Refer to individual Division 23 piping Sections for special joining materials not listed below.

Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

- A. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness, unless thickness or specific material is indicated.
 - 1. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - 2. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

Solder Filler Metals: ASTM B 32.

- A. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
- B. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.

Brazing Filler Metals: AWS A5.8.

- A. BCuP Series: Copper-phosphorus alloys.
- B. BAg1: Silver alloy.

Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.

- A. Sleeve: ASTM A 126, Class B, gray iron.
- B. Followers: ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 536 ductile iron.
- C. Gaskets: Rubber.
- D. Bolts and Nuts: AWWA C111.
- E. Finish: Enamel paint.

DIELECTRIC FITTINGS:

General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

Insulating Material: Suitable for system fluid, pressure, and temperature.

Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

- A. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F

(107 deg C).

FLEXIBLE CONNECTORS:

General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig (860-kPa) minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:

- A. 2-Inch NPS (DN50) and Smaller: Threaded.
- B. 2-1/2-Inch NPS (DN65) and Larger: Flanged.
- C. Option for 2-1/2-Inch NPS (DN65) and Larger: Grooved for use with keyed couplings.

Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

MECHANICAL SLEEVE SEALS:

Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

PIPING SPECIALTIES:

Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

- A. Steel Sheet Metal: 0.0239-inch (0.6-mm) minimum thickness, galvanized, round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral water stop, 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.

Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.

- A. ID: Closely fit around pipe, tube, and insulation of insulated piping.
- B. OD: Completely cover opening.
- C. Cast Brass: One piece, with set screw.
 - 1. Finish: Rough brass.
 - 2. Finish: Polished chrome-plate.
- D. Cast Brass: Split casting, with concealed hinge and set screw.
 - 1. Finish: Rough brass.
 - 2. Finish: Polished chrome-plate.
- E. Stamped Steel: One piece, with set screw and chrome-plated finish.
- F. Stamped Steel: One piece, with spring clips and chrome-plated finish.
- G. Stamped Steel: Split plate, with concealed hinge, set screw, and chrome-plated finish.

- H. Stamped Steel: Split plate, with concealed hinge, spring clips, and chrome-plated finish.
- I. Stamped Steel: Split plate, with exposed-rivet hinge, set screw, and chrome-plated finish.
- J. Stamped Steel: Split plate, with exposed-rivet hinge, spring clips, and chrome-plated finish.
- K. Cast-Iron Floor Plate: One-piece casting.

GROUT:

Non-shrink, Nonmetallic Grout: ASTM C 1107, Grade B.

- A. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
- B. Design Mix: 5000-psig (34.5-MPa), 28-day compressive strength.
- C. Packaging: Premixed and factory packaged.

PART 3 EXECUTION**PIPING SYSTEMS - COMMON REQUIREMENTS:**

General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 23 piping Sections specify unique piping installation requirements.

General Locations and Arrangements: 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.

Install piping at indicated slope.

Install components with pressure rating equal to or greater than system operating pressure.

Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

Install piping free of sags and bends.

Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation.

Locate groups of pipes parallel to each other, spaced to permit valve servicing.

Install fittings for changes in direction and branch connections.

Install couplings according to manufacturer's written instructions.

Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

- A. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
- B. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
- C. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
- D. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
- E. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.

Sleeves are not required for core drilled holes.

Permanent sleeves are not required for holes formed by PE removable sleeves.

Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.

Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

- A. Cut sleeves to length for mounting flush with both surfaces.
 - 1. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
- B. Build sleeves into new walls and slabs as work progresses.
- C. Install sleeves large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - 1. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS (DN150).
 - 2. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS (DN150) and larger, penetrating gypsum-board partitions.
 - 3. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
 - a. Seal space outside of sleeve fittings with non-shrink, nonmetallic grout.
- D. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 7 Section "Joint Sealants" for materials.
- E. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

- A. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
- B. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) in diameter and larger.
- C. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

- A. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 7 Section "Firestopping" for materials.

Verify final equipment locations for roughing-in.

Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

- 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. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 - 2. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
 - 3. Align threads at point of assembly.
 - 4. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
 - 5. 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.
- F. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
- G. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

Piping Connections: Make connections according to the following, unless otherwise indicated:

- A. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.
- B. Install flanges, in piping 2-1/2-inch NPS (DN65) and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
- C. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

- D. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

EQUIPMENT INSTALLATION - COMMON REQUIREMENTS:

Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.

Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

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.

Install equipment giving right of way to piping installed at required slope.

Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

PAINTING AND FINISHING:

Refer to Division 9 Section "Painting" for paint materials, surface preparation, and application of paint.

Apply paint to exposed piping according to the following, unless otherwise indicated:

- A. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
- B. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
- C. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
- D. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
- E. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
- F. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

Do not paint piping specialties with factory-applied finish.

Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

CONCRETE BASES:

Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

ERECTION OF METAL SUPPORTS AND ANCHORAGE:

Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

ERECTION OF WOOD SUPPORTS AND ANCHORAGE:

Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.

Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

Attach to substrates as required to support applied loads.

DEMOLITION:

Disconnect, demolish, and remove Work specified in Division 23 Sections.

If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches (50 mm) beyond face of adjacent construction. Cap and patch surface to match existing finish.

Removal: Remove indicated equipment from Project site.

Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

CUTTING AND PATCHING:

Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

Repair cut surfaces to match adjacent surfaces.

GROUTING:

Install nonmetallic, non-shrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

Clean surfaces that will come into contact with grout.

Provide forms as required for placement of grout.

Avoid air entrapment during placing of grout.

Place grout, completely filling equipment bases.

Place grout on concrete bases to provide smooth bearing surface for equipment.

Place grout around anchors.

Cure placed grout according to manufacturer's written instructions.

END OF SECTION

23 05 13 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes basic requirements for factory-installed and field-installed motors.

Related Sections include the following:

Division 23 Sections for application of motors and reference to specific motor requirements for motor-driven equipment.

SUBMITTALS:

Product Data: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.

Factory Test Reports: For specified tests.

Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

QUALITY ASSURANCE:

Comply with NFPA 70.

Listing and Labeling: Provide motors specified in this Section that are listed and labeled.

- A. Terms "Listed and Labeled": As defined in the National Electrical Code, Article 100.
- B. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

PART 2 PRODUCTS**BASIC MOTOR REQUIREMENTS:**

Basic requirements apply to mechanical equipment motors, unless otherwise indicated.

Motors 1/2 HP and Larger: Polyphase, unless otherwise noted.

Motors Smaller than 1/2 HP: Single phase.

Frequency Rating: 60 Hz.

Voltage Rating: Determined by voltage of circuit to which motor is connected.

Service Factor: 1.15, unless otherwise indicated.

Capacity and Torque Characteristics: Rated for continuous duty and sufficient to start, accelerate, and operate connected loads at designated speeds, in indicated environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

Enclosure: Open dripproof, unless otherwise indicated.

POLYPHASE MOTORS:

Description: NEMA MG 1, medium induction motor.

- A. Design Characteristics: NEMA MG 1, Design B, unless otherwise indicated.
- B. Energy-Efficient Design: High efficiency.
- C. Starter: Copper windings, unless otherwise indicated. Multispeed motors 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.

Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for indicated controller, with required motor leads brought to motor terminal box to suit control method.

Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

- A. Critical vibration frequencies are not within operating range of controller output.
- B. Temperature Rise: Match rating for Class B insulation.
- C. Insulation: Class H.
- D. Thermal Protection: Where indicated, conform to NEMA MG 1 requirements for thermally protected motors.
- E. Shaft grounding rings.

Rugged-Duty Motors: Where indicated, motors are totally enclosed with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings are insulated with non-hygroscopic material. External finish is chemical-resistant paint over corrosion-resistant primer.

Source Quality Control: Perform the following routine tests according to NEMA MG 1:

- A. Measurement of winding resistance.
- B. No-load readings of current and speed at rated voltage and frequency.
- C. Locked rotor current at rated frequency.
- D. High-potential test.
- E. Alignment.

SINGLE-PHASE MOTORS:

Type: As indicated or selected by manufacturer from one of the following, to suit starting torque and other requirements of specific motor application.

- A. Permanent-split capacitor.

- B. Split-phase start, capacitor run.
- C. Capacitor start, capacitor run.

Shaded-Pole Motors: Do not use, unless motors are smaller than 1/20 hp.

Thermal Protection: Where indicated or required, internal protection automatically opens power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal protection device automatically resets when motor temperature returns to normal range, unless otherwise indicated.

Bearings: Ball-bearing type for belt-connected motors and other motors with high radial forces on motor shaft. Sealed, pre-lubricated sleeve bearings for other single-phase motors.

PART 3 EXECUTION

ADJUSTING:

Use adjustable motor mounting bases for belt-driven motors.

Align pulleys and install belts.

Tension according to manufacturer's written instructions.

END OF SECTION

23 05 19 METERS AND GAGES FOR HVAC PIPING

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes meters and gages for mechanical systems and water meters installed outside the building.

Related Sections include the following:

- A. Division 23 Section "Natural Gas Piping" for gas meters.
- B. Mechanical equipment Sections that specify meters and gages as part of factory-fabricated equipment.

SUBMITTALS:

Product Data: Include scale range, ratings, and calibrated performance curves for each meter, gage, fitting, specialty, and accessory specified. Include schedule indicating manufacturer's number, scale range, fittings, and location for each meter and gage.

Maintenance Data: For meters and gages to include in maintenance manuals specified in Division 1. Include data for the following:

- A. Flow-measuring systems.
- B. Water meters.

PART 2 PRODUCTS**MANUFACTURERS:**

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Liquid-in-Glass Thermometers:
 - 1. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
 - 2. Ernst Gage Co.
 - 3. Marsh Bellofram.
 - 4. Palmer Instruments, Inc.
 - 5. Trerice: H. O. Trerice Co.
 - 6. Weksler.
- B. Direct-Mounting, Filled-System Dial Thermometers:
 - 1. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
 - 2. Marsh Bellofram.
 - 3. Trerice: H. O. Trerice Co.
 - 4. Weksler.

- C. Insertion Dial Thermometers:
 - 1. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
 - 2. Trerice: H. O. Trerice Co.
 - 3. Weiss Instruments, Inc.
 - 4. Weksler.
- D. Pressure Gages:
 - 1. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
 - 2. Ernst Gage Co.
 - 3. Marsh Bellofram.
 - 4. Weiss Instruments, Inc.
 - 5. Weksler.
- E. Test Plugs:
 - 1. Peterson Equipment Co., Inc.
 - 2. Trerice: H. O. Trerice Co.
 - 3. Watts Industries, Inc.; Water Products Div.
- F. Wafer-Orifice-Type Flow Elements:
 - 1. ABB, Inc.; ABB Instrumentation.
 - 2. Armstrong Pumps, Inc.
 - 3. Badger Meter, Inc.; Industrial Div. (Tulsa, OK).
- G. Flow Indicators:
 - 1. Dwyer Instruments, Inc.
 - 2. Ernst Gage Co.
 - 3. Eugene Ernst Products Co.

THERMOMETERS, GENERAL:

Scale Range: Temperature ranges for services listed are as follows:

- A. Hot Water: 30 to 300 deg F, with 2-degree scale divisions (0 to 150 deg C, with 1-degree scale divisions).
- B. Chilled Water: 0 to 100 deg F, with 2-degree scale divisions (minus 18 to plus 38 deg C, with 1-degree scale divisions).

Accuracy: Plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.

LIQUID-IN-GLASS THERMOMETERS:

Description: ASTM E 1.

Case: Die cast and aluminum finished in baked-epoxy enamel, glass front, spring secured, 9 inches (230 mm) long.

Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.

Tube: Red or blue reading, organic-liquid filled with magnifying lens.

Scale: Satin-faced nonreflective aluminum with permanently etched markings.

Stem: Copper-plated steel, aluminum, or brass for separable socket; of length to suit installation.

DIRECT-MOUNTING, FILLED-SYSTEM DIAL THERMOMETERS:

Description: Vapor-actuated, universal-angle dial type.

Case: Drawn steel or cast aluminum, with 4-1/2-inch- (115-mm-) diameter, glass lens.

Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.

Thermal Bulb: Copper with phosphor-bronze bourdon pressure tube.

Movement: Brass, precision geared.

Scale: Progressive, satin-faced nonreflective aluminum with permanently etched markings.

Stem: Copper-plated steel, aluminum, or brass for separable socket; of length to suit installation.

INSERTION DIAL THERMOMETERS:

Description: ASME B40.3, bimetal type.

Dial: 1-inch (25-mm) diameter.

Case: Stainless steel.

Stem: Dustproof and leakproof 1/8-inch- (3-mm-) diameter, tapered-end stem with nominal length of 5 inches (125 mm).

SEPARABLE SOCKETS:

Description: Fitting with protective socket for installation in threaded pipe fitting to hold fixed thermometer stem.

- A. Material: Brass, for use in copper piping.
- B. Material: Steel, for use in steel piping.
- C. Extension-Neck Length: Nominal thickness of 2 inches (50 mm), but not less than thickness of insulation. Omit extension neck for sockets for piping not insulated.
- D. Insertion Length: To extend to center of pipe.
- E. Heat-Transfer Fluid: Oil or graphite.

THERMOMETER WELLS:

Description: Fitting with protective well for installation in threaded pipe fitting to hold test thermometer.

- A. Material: Brass, for use in copper piping.
- B. Material: Steel, for use in steel piping.
- C. Extension-Neck Length: Nominal thickness of 2 inches (50 mm), but not less than thickness of insulation. Omit extension neck for wells for piping not insulated.
- D. Insertion Length: To extend to center of pipe.
- E. Heat-Transfer Fluid: Oil or graphite.

PRESSURE GAGES:

Description: ASME B40.1, phosphor-bronze bourdon-tube type with bottom connection; dry type, unless liquid-filled-case type is indicated.

Case: Drawn steel, brass, or aluminum with 4-1/2-inch- (115-mm-) diameter, glass lens.

Connector: Brass, NPS 1/4 (DN8).

Scale: White-coated aluminum with permanently etched markings.

Accuracy: Grade A, plus or minus 1 percent of middle 50 percent of scale.

Range: Comply with the following:

- A. Vacuum: 30 inches Hg of vacuum to 15 psig of pressure (100 kPa of vacuum to 103 kPa of pressure).
- B. Fluids under Pressure: Two times the operating pressure.

PRESSURE-GAGE FITTINGS:

Valves: NPS 1/4 (DN8) brass or stainless-steel needle type.

Syphons: NPS 1/4 (DN8) coil of brass tubing with threaded ends.

Snubbers: ASME B40.5, NPS 1/4 (DN8) brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.

TEST PLUGS:

Description: Nickel-plated, brass-body test plug in NPS 1/2 (DN15) fitting.

Body: Length as required to extend beyond insulation.

Pressure Rating: 500 psig (3450 kPa) minimum.

Core Inserts: Two self-sealing valves, suitable for inserting 1/8-inch (3-mm) OD probe from dial-type thermometer or pressure gage.

Core Material for Air, Water, Oil, and Gas: 20 to 200 deg F (Minus 7 to plus 93 deg C), chlorosulfonated polyethylene synthetic rubber.

Test-Plug Cap: Gasketed and threaded cap, with retention chain or strap.

FLOW-MEASURING SYSTEMS:

System includes calibrated flow element, separate meter, hoses or tubing, valves, fittings, and conversion chart compatible with flow element, meter, and system fluid.

- A. Flow range of flow-measuring element and meter covers operating range of equipment or system where used.
- B. Display: Visual instantaneous rate of flow.

FLOW INDICATORS:

Description: Instrument for visual verification of flow; made for installation in piping systems.

- A. Construction: Bronze or stainless-steel body, with sight glass and plastic pelton-wheel indicator.
- B. Pressure Rating: 125 psig (860 kPa).
- C. Temperature Rating: 200 deg F (93 deg C).

PART 3 EXECUTION**METER AND GAGE INSTALLATION, GENERAL:**

Install meters, gages, and accessories according to manufacturer's written instructions for applications where used.

THERMOMETER INSTALLATION:

Install thermometers and adjust vertical and tilted positions.

Install in the following locations:

- A. Inlet and outlet of each hydronic boiler and chiller.
- B. Inlet and outlet of each hydronic coil in air-handling units and built-up central systems.
- C. Inlet and outlet of each hydronic heat exchanger.
- D. Inlet and outlet of each hydronic heat-recovery unit.
- E. Inlet and outlet of each thermal storage tank.

Install separable sockets in vertical position in piping tees where fixed thermometers are indicated.

- A. Install with socket extending to center of pipe.
- B. Fill sockets with oil or graphite.

Install thermometer wells in vertical position in piping tees where test thermometers are indicated.

- A. Install with stem extending to center of pipe.
- B. Fill wells with oil or graphite and secure caps.

PRESSURE-GAGE INSTALLATION:

Install pressure gages in piping tees with pressure-gage valve located on pipe at most readable position.

Install dry-type pressure gages in the following locations:

- A. Discharge of each pressure-reducing valve.
- B. Building water-service entrance.
- C. Chilled-water and condenser-water inlets and outlets of chillers.

Install liquid-filled-type pressure gages at suction and discharge of each pump.

Install pressure-gage needle valve and snubber in piping to pressure gages.

Exception: Install syphon instead of snubber in piping to steam pressure gages.

FLOW-MEASURING SYSTEM INSTALLATION:

Install flow-measuring elements and meters at discharge of each pump, at inlet of each hydronic coil in built-up central systems, and elsewhere as indicated.

Install wafer-orifice-type flow elements between two pipe flanges.

Install connection fittings for attachment to portable flowmeters in accessible locations.

Install connections, tubing, and accessories between flow elements and meters as prescribed by manufacturer's written instructions.

CONNECTIONS:

Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping and specialties. The following are specific connection requirements:

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance.
- B. Connect flow-measuring-system elements to meters.
- C. Connect flowmeter transmitters to meters.

Electrical Contractor to make connections to power supply and electrically operated meters and devices.

Ground electrically operated meters.

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.

Install electrical connections for power and devices.

Electrical power, wiring, and connections are specified in Division 26 Sections.

ADJUSTING AND CLEANING:

Calibrate meters according to manufacturer's written instructions, after installation.

Adjust faces of meters and gages to proper angle for best visibility.

Clean windows of meters and gages and clean factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touchup paint.

END OF SECTION

23 05 23 GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes general duty valves common to several mechanical piping systems.

Related Sections: The following Sections contain requirements that relate to this Section:

- A. Special purpose valves are specified in Division 23 piping system Sections.
- B. Valve tags and charts are specified in Division 23 Section "Mechanical Identification."

SUBMITTALS:

General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

Product Data for each valve type. Include body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions. Include list indicating valve and its application.

Maintenance data for valves to include in the operation and maintenance manual specified in Division 1. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

QUALITY ASSURANCE:

Single-Source Responsibility: Comply with the requirements specified in Division 1 Section "Materials and Equipment," under "Source Limitations" Paragraph.

ASME Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.

MSS Compliance: Comply with the various MSS Standard Practice documents referenced.

DELIVERY, STORAGE, AND HANDLING:

Prepare valves for shipping as follows:

- A. Protect internal parts against rust and corrosion.
- B. Protect threads, flange faces, grooves, and weld ends.
- C. Set globe and gate valves closed to prevent rattling.
- D. Set ball and plug valves open to minimize exposure of functional surfaces.
- E. Set butterfly valves closed or slightly open.
- F. Block check valves in either closed or open position.

Use the following precautions during storage:

- A. Maintain valve end protection.
- B. Store indoors and maintain valve temperature higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

Use a sling to handle large valves. Rig to avoid damage to exposed parts. Do not use handwheels and stems as lifting or rigging points.

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Ball Valves:
 - 1. Hammond Valve Corporation.
 - 2. Milwaukee Valve Company, Inc.
 - 3. NIBCO Inc.
 - 4. Stockham Valves & Fittings, Inc.
 - 5. Victaulic Company of America.
 - 6. Apollo.
- B. Plug Valves:
 - 1. NIBCO Inc.
 - 2. Stockham Valves & Fittings, Inc.
 - 3. Victaulic Company of America.
- C. Globe Valves:
 - 1. Hammond Valve Corporation.
 - 2. Milwaukee Valve Company, Inc.
 - 3. NIBCO Inc.
 - 4. Stockham Valves & Fittings, Inc.
- D. Butterfly Valves:
 - 1. Center Line, Mark Controls Corporation.
 - 2. Hammond Valve Corporation.
 - 3. Keystone Valve USA, Inc.
 - 4. Milwaukee Valve Company, Inc.
 - 5. NIBCO Inc.
 - 6. Stockham Valves & Fittings, Inc.
 - 7. Victaulic Company of America.
- E. Swing Check Valves:
 - 1. Hammond Valve Corporation.
 - 2. Milwaukee Valve Company, Inc.
 - 3. NIBCO Inc.
 - 4. Stockham Valves & Fittings, Inc.
 - 5. Victaulic Company of America.

BASIC, COMMON FEATURES:

Design: Rising stem or rising outside screw and yoke stems, except as specified below.

Non-rising stem valves may be used only where headroom prevents full extension of rising stems.

Pressure and Temperature Ratings: As indicated in the "Application Schedule" of Part 3 of this Section and as required to suit system pressures and temperatures.

Sizes: Same size as upstream pipe, unless otherwise indicated.

Operators: Use specified operators and handwheels, except provide the following special operator features:

- A. Handwheels: For valves other than quarter turn.
- B. Lever Handles: For quarter-turn valves 6 inches (DN150) and smaller, except for plug valves, which shall have square heads. Furnish Owner with 1 wrench for every 10 plug valves.
- C. Chain-Wheel Operators: For valves 4 inches (DN100) and larger, installed 84 inches (2400 mm) or higher above finished floor elevation.
- D. Gear-Drive Operators: For quarter-turn valves 8 inches (DN200) and larger.

Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.

Bypass and Drain Connections: Comply with MSS SP-45 bypass and drain connections.

Threads: ASME B1.20.1.

Flanges: ASME B16.1 for cast iron, ASME B16.5 for steel, and ASME B16.24 for bronze valves.

Solder Joint: ASME B16.18.

Caution: Where soldered end connections are used, use solder having a melting point below 840 deg F (450 deg C) for gate, globe, and check valves; below 421 deg F (216 deg C) for ball valves.

BALL VALVES:

Ball Valves, 4 Inches (DN100) and Smaller: MSS SP-110, Class 150, 600-psi (4140-kPa) CWP, ASTM B 584 bronze body and bonnet, 2-piece construction; chrome-plated brass ball, standard port for 1/2-inch (DN15) valves and smaller and full port for 3/4-inch (DN20) valves and larger; blowout proof; bronze or brass stem; teflon seats and seals; threaded or soldered end connections:

Operator: Vinyl-covered steel lever handle, unless noted otherwise.

PLUG VALVES:

Plug Valves: MSS SP-78, 175-psi (1200-kPa) CWP, ASTM A 126 cast-iron body and bonnet, cast-iron plug, Buna N, Viton, or teflon packing, flanged or grooved end connections:

Operator: Lever.

GLOBE VALVES:

Globe Valves, 2-1/2 Inches (DN65) and Smaller: MSS SP-80; Class 125, 200-psi (1380-kPa) CWP, or Class 150, 300-psi (2070-kPa) CWP; ASTM B 62 cast-bronze body and screwed bonnet, rubber, bronze, or teflon disc, silicon bronze-alloy stem, teflon-impregnated packing with bronze nut, threaded or soldered end connections; and with aluminum or malleable-iron handwheel.

Globe Valves, 3 Inches (DN80) and Larger: MSS SP-85, Class 125, 200-psi (1380-kPa) CWP, ASTM A 126 cast-iron body and bolted bonnet with bronze fittings, renewable bronze seat and disc, brass-alloy stem, outside screw and yoke, teflon-impregnated packing with cast-iron follower, flanged end connections; and with cast-iron handwheel.

BUTTERFLY VALVES:

Butterfly Valves: MSS SP-67, 200-psi (1380-kPa) CWP, 150-psi (1035- kPa) maximum pressure differential, ASTM A 126 cast-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals, wafer, lug, or grooved style:

Disc Type: Aluminum bronze.

Operator for Sizes 2 Inches (DN50) to 6 Inches (DN150): Standard lever handle with memory stop.

Operator for Sizes 8 Inches (DN200) to 24 Inches (DN600): Gear operator with position indicator and chain wheel if operator is higher than 84" above floor.

CHECK VALVES:

Swing Check Valves, 2-1/2 Inches (DN65) and Smaller: MSS SP-80; Class 125, 200-psi (1380-kPa) CWP, or Class 150, 300-psi (2070-kPa) CWP; horizontal swing, Y-pattern, ASTM B 62 cast-bronze body and cap, rotating bronze disc with rubber seat or composition seat, threaded or soldered end connections, non-slam.

Swing Check Valves, 3 Inches (DN80) and Larger: MSS SP-71, Class 125, 200-psi (1380-kPa) CWP, ASTM A 126 cast-iron body and bolted cap, horizontal-swing bronze disc, flanged or grooved end connections, non-slam.

PART 3 EXECUTION**EXAMINATION:**

Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.

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.

Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.

Examine threads on valve and mating pipe for form and cleanliness.

Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.

Do not attempt to repair defective valves; replace with new valves.

INSTALLATION:

Install valves as indicated, according to manufacturer's written instructions.

Piping installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.

Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.

Locate valves for easy access and provide separate support where necessary.

Install valves in horizontal piping with stem at or above the center of the pipe.

Install valves in a position to allow full stem movement.

For chain-wheel operators, extend chains to 60 inches (1500 mm) above finished floor elevation.

Install check valves for proper direction of flow as follows in a horizontal or vertical position with hinge pin level.

SOLDERED CONNECTIONS:

Cut tube square and to exact lengths.

Clean end of tube to depth of valve socket with steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket.

Apply proper soldering flux in an even coat to inside of valve socket and outside of tube.

Open gate and globe valves to fully open position.

Remove the cap and disc holder of swing check valves having composition discs.

Insert tube into valve socket, making sure the end rests against the shoulder inside valve. Rotate tube or valve slightly to ensure even distribution of the flux.

Apply heat evenly to outside of valve around joint until solder melts on contact. Feed solder until it completely fills the joint around tube. Avoid hot spots or overheating valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush.

THREADED CONNECTIONS:

Note the internal length of threads in valve ends and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve.

Align threads at point of assembly.

Apply appropriate tape or thread compound to the external pipe threads, except where dry seal threading is specified.

Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

FLANGED CONNECTIONS:

Align flange surfaces parallel.

Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

For dead-end service, butterfly valves require flanges both upstream and downstream for proper shutoff and retention.

VALVE END SELECTION:

Select valves with the following ends or types of pipe/tube connections:

- A. Copper Tube Size, 2-1/2 Inches (DN65) and Smaller: Solder ends, except provide threaded ends for heating hot water and low-pressure steam service.
- B. Steel Pipe Sizes, 2 Inches (DN65) and Smaller: Threaded or grooved end.
- C. Steel Pipe Sizes, 2-1/2 Inches (DN80) and Larger: Grooved end or flanged.

APPLICATION SCHEDULE:

General Application: Use ball and butterfly valves for shutoff duty; globe, ball, and butterfly for throttling duty. Refer to piping system Specification Sections for specific valve applications and arrangements.

- A. Heating Water Systems: Use the following valve types:
 - 1. Ball Valves: Class 150, 600-psi (4140-kPa) CWP, with stem extension and memory stop.
 - 2. Globe Valves: Class 150, bronze or cast-iron body to suit piping system, and bronze disc.
 - 3. Butterfly Valves: Nickel-plated ductile iron, aluminum bronze, or epoxy-coated ductile iron disc; EPDM or Buna N sleeve and stem seals.
 - 4. Bronze Swing Check: Class 150, with composition seat.
- B. Chilled-Water Systems: Use the following valve types:
 - 1. Ball Valves: Class 150, 600-psi (4140-kPa) CWP, with stem extension and memory stop.
 - 2. Plug Valves: Buna N packing.
 - 3. Globe Valves: Class 125, bronze body with bronze or teflon disc; or Class 125, cast-iron body.
 - 4. Butterfly Valves: Nickel-plated ductile iron, aluminum bronze, or elastomer-coated ductile iron disc; EPDM sleeve and stem seals.
 - 5. Check Valves: Class 125, bronze body swing check with rubber seat; Class 125, cast-iron body swing check; Class 125, cast-iron body wafer check; or Class 125, cast-iron body lift check.

ADJUSTING:

Adjust or replace packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves if leak persists.

END OF SECTION

23 05 29 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes hangers and supports for mechanical system piping and equipment.

Related Sections include the following:

- A. Division 5 Section "Metal Fabrications" for materials for attaching hangers and supports to building structure.
- B. Division 21 Sections on fire-suppression piping for fire-suppression pipe hangers.
- C. Division 23 Section "Mechanical Vibration Controls and Seismic Restraints" for vibration isolation and seismic restraint devices.

DEFINITIONS:

MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

PERFORMANCE REQUIREMENTS:

Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

SUBMITTALS:

Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.

Welding Certificates: Copies of certificates for welding procedures and operators.

QUALITY ASSURANCE:

Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, and seismic restraint by a qualified professional engineer.

- A. 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 hangers and supports that are similar to those indicated for this Project in material, design, and extent.

PART 2 PRODUCTS

MANUFACTURERS:

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. Pipe Hangers:
 - 1. AAA Technology and Specialties Co., Inc.
 - 2. B-Line Systems, Inc.
 - 3. Globe Pipe Hanger Products, Inc.
 - 4. Grinnell Corp.
 - 5. GS Metals Corp.
 - 6. National Pipe Hanger Corp.
 - 7. PHD Manufacturing, Inc.
 - 8. PHS Industries, Inc.
 - 9. Piping Technology & Products, Inc.
- B. Channel Support Systems:
 - 1. B-Line Systems, Inc.
 - 2. Grinnell Corp.; Power-Strut Unit.
 - 3. GS Metals Corp.
 - 4. National Pipe Hanger Corp.
 - 5. Thomas & Betts Corp.
 - 6. Unistrut Corp.
- C. Thermal-Hanger Shield Inserts:
 - 1. PHS Industries, Inc.
 - 2. Pipe Shields, Inc.
 - 3. Rilco Manufacturing Co., Inc.
 - 4. Value Engineered Products, Inc.
- D. Powder-Actuated Fastener Systems:
 - 1. Gunnebo Fastening Corp.
 - 2. Hilti, Inc.
 - 3. ITW Ramset/Red Head.
 - 4. Masterset Fastening Systems, Inc.

MANUFACTURED UNITS:

Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.

- A. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
- B. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

- A. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- B. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive-strength insulation, encased in sheet metal shield.

- A. Material for Piping: ASTM C 552, Type I cellular glass or high density polyisocyanurate insulation.
- B. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
- C. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
- D. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield.

MISCELLANEOUS MATERIALS:

Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, non-shrink and nonmetallic, dry, hydraulic-cement grout.

- A. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
- B. Properties: Non-staining, noncorrosive, and nongaseous.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 EXECUTION

HANGER AND SUPPORT APPLICATIONS:

Specific hanger requirements are specified in Sections specifying equipment and systems.

Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

All hangers are to be sized to allow for continuous installation of insulation and thermal insulation shield. Hangers are to be sized to match the O.D. of insulated pipes or O.D. of uninsulated pipes.

Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

- A. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN15 to DN750).
- B. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN100 to DN400), requiring up to 4 inches (100 mm) of insulation.

Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

- A. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500).
- B. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500), if longer ends are required for riser clamps.

Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

- A. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
- B. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- C. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
- D. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
- E. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

- A. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
- B. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
- C. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
- D. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
- E. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
- F. C-Clamps (MSS Type 23): For structural shapes.
- G. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
- H. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
- I. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
- J. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
- K. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
- L. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - 1. Light (MSS Type 31): 750 lb (340 kg).
 - 2. Medium (MSS Type 32): 1500 lb (675 kg).
 - 3. Heavy (MSS Type 33): 3000 lb (1350 kg).
- M. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- N. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- O. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where head room is limited.

Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

- A. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
- B. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
- C. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi (690-kPa) minimum compressive-strength, high density polyisocyanurate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

HANGER AND SUPPORT INSTALLATION:

Pipe Hanger and Support 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.

Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.

- A. Field assemble and install according to manufacturer's written instructions.

Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.

- A. 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.
- B. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, 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.

Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

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.

Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

Insulated Piping: Comply with the following:

- A. Attach clamps and spacers to piping.
 - 1. Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - 2. Do not exceed pipe stress limits according to ASME B31.9.
- B. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - 1. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
- C. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.
 - 1. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
- D. Shield Dimensions for Pipe: Not less than the following:
 - 1. NPS 1/4 to NPS 3-1/2 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - 2. NPS 4 (DN100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - 3. NPS 5 and NPS 6 (DN125 and DN150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
 - 4. NPS 8 to NPS 14 (DN200 to DN350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
 - 5. NPS 16 to NPS 24 (DN400 to DN600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
- E. Insert Material: Length at least as long as protective shield.
- F. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

EQUIPMENT SUPPORTS:

Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

Grouting: Place grout under supports for equipment and make smooth bearing surface.

METAL FABRICATION:

Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

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:

- A. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
- B. Obtain fusion without undercut or overlap.
- C. Remove welding flux immediately.
- D. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

ADJUSTING:

Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

PAINTING:

Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 Section "Painting."

Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

23 05 53 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes mechanical identification materials and devices.

SUBMITTALS:

Product Data: For identification materials and devices.

Samples: Of color, lettering style, and graphic representation required for each identification material and device.

Valve Schedules: For each piping system. Reproduce on standard-size bond paper. Tabulate valve number, piping system, system abbreviation as shown on tag, room or space location of valve, and variations for identification. Mark valves intended for emergency shutoff and similar special uses. Besides mounted copies, furnish copies for maintenance manuals specified in Division 1.

QUALITY ASSURANCE:

Comply with ASME A13.1, "Scheme for the Identification of Piping Systems" for lettering size, length of color field, colors, and viewing angles of identification devices.

SEQUENCING AND SCHEDULING:

Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS**IDENTIFYING DEVICES AND LABELS:**

General: Products specified are for applications referenced in other Division 23 Sections. If more than single type is specified for listed applications, selection is Installer's option.

Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

- A. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
- B. Location: Accessible and visible.

Snap-On Plastic Pipe Markers: Manufacturer's standard preprinted, semi-rigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

- A. Arrows: Either integrally with piping system service lettering, to accommodate both directions, or as separate unit, on each pipe marker to indicate direction of flow.

Valve Tags: Stamped or engraved with 1/4-inch (6-mm) letters for piping system abbreviation and 1/2-inch (13-mm) sequenced numbers. Include 5/32-inch (4-mm) hole for fastener.

- B. Material: 0.032-inch- (0.8-mm-) thick, polished brass.
- C. Size: 1-1/2-inches (40-mm) diameter, unless otherwise indicated.
- D. Shape: As indicated for each piping system.

Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

Access Panel Markers: 1/16-inch- (2-mm-) thick, engraved plastic-laminate markers, with abbreviated terms and numbers corresponding to concealed valve. Provide 1/8-inch (3-mm) center hole for attachment.

Valve Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include screws.

- A. Frame: Extruded aluminum.
- C. Glazing: ASTM C 1036, Type I, Class 1, Glazing quality B, 2.5-mm, single-thickness glass.

Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

- A. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
- B. Thickness: 1/16 inch (2 mm), for units up to 20 sq. in. (130 sq. cm) or 8 inches (200 mm) in length, and 1/8 inch (3 mm) for larger units.
- C. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

- A. Green: Cooling equipment and components.
- B. Yellow: Heating equipment and components.
- C. Brown: Energy reclamation equipment and components.
- D. Blue: Equipment and components that do not meet criteria above.
- E. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
- F. Terminology: Match schedules as closely as possible. Include the following:
 - 1. Name and plan number.
 - 2. Equipment service.
 - 3. Design capacity.
 - 4. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
- G. Size: 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.

Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.

- A. Size: 3-1/4 by 5-5/8 inches (85 by 145 mm).
- B. Fasteners: Brass grommets and wire.
- C. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of mechanical systems and equipment.

- A. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

PART 3 EXECUTION

LABELING AND IDENTIFYING PIPING SYSTEMS:

Install pipe markers on each system. Include arrows showing normal direction of flow.

Marker Type: Plastic markers, with application systems. Install on pipe insulation segment where required for hot, non-insulated pipes.

Fasten markers on pipes and insulated pipes smaller than 6 inches (150 mm) OD by one of following methods:

- A. Snap-on application of pretensioned, semirigid plastic pipe marker.

Fasten markers on pipes and insulated pipes 6 inches (150 mm) in diameter and larger by one of following methods:

- A. Strapped to pipe or insulation with manufacturer's standard stainless-steel bands.

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 according to the following:

- A. Near each valve and control device.
- B. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
- C. Near penetrations through walls, floors, ceilings, or non-accessible enclosures.
- D. At access doors, manholes, and similar access points that permit view of concealed piping.
- E. Near major equipment items and other points of origination and termination.
- F. Spaced at a maximum of 50-foot (15-m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in areas of congested piping and equipment.
- G. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

VALVE TAGS:

Install on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, plumbing fixture supply stops, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of

end-use fixtures and units. List tagged valves in valve schedule.

Valve Tag Application Schedule: Tag valves according to size, shape, color scheme, and with captions similar to those indicated in the following:

Tag Material: Brass.

Tag Size and Shape: According to the following:

- A. Chilled Water: 1-1/2 inches (40 mm), round.
- B. Heating Water: 1-1/2 inches (40 mm), round.
- C. Condenser Water: 1-1/2 inches (40 mm), round.
- D. Gas: 1-1/2 inches (40 mm), round.

Tag Color: According to the following:

- A. Condenser Water: Black.
- B. Chilled Water: Green.
- C. Heating Water: Orange.
- D. Gas: Yellow.

Letter Color: According to the following:

- A. Chilled Water: White.
- B. Condenser Water: White.
- C. Heating Water: Black.
- D. Gas: Black.

Install mounted valve schedule in each major equipment room.

EQUIPMENT SIGNS AND MARKERS:

Install engraved plastic-laminate signs or equipment markers on or near each major item of mechanical equipment. Include signs for the following general categories of equipment:

- A. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
- B. Fire department hose valves and hose stations.
- C. Meters, gages, thermometers, and similar units.
- D. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
- E. Pumps, compressors, chillers, condensers, and similar motor-driven units.
- F. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
- G. Fans, blowers, primary balancing dampers, and mixing boxes.
- H. Packaged HVAC central-station and zone-type units.
- I. Tanks and pressure vessels.
- J. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

Plasticized Tags: Install within concealed space, to reduce amount of text in exposed sign outside concealment, if equipment to be identified is concealed above acoustical ceiling or similar concealment.

- A. Identify operational valves and similar minor equipment items located in unoccupied spaces, including machine rooms, by installing plasticized tags.

ADJUSTING AND CLEANING:

Relocate mechanical identification materials and devices that have become visually blocked by work of this or other Divisions.

Clean faces of identification devices and glass frames of valve charts.

END OF SECTION

23 05 93 TESTING AND BALANCING

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:

- A. Balancing airflow and water flow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
- A. Adjusting total HVAC systems to provide indicated quantities.
- B. Measuring electrical performance of HVAC equipment.
- C. Setting quantitative performance of HVAC equipment.
- D. Verifying that automatic control devices are functioning properly.
- E. Reporting results of the activities and procedures specified in this Section.

Related Sections include the following:

- A. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.
- B. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

DEFINITIONS:

Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.

Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

Report Forms: Test data sheets for recording test data in logical order.

Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

Test: A procedure to determine quantitative performance of a system or equipment.

Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.

AMCA: Air Movement and Control Association.

CTI: Cooling Tower Institute.

NEBB: National Environmental Balancing Bureau.

SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

SUBMITTALS:

Quality-Assurance Submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.

Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3 of this Section.

Strategies and Procedures Plan: Within 60 days from the Contractor's Notice to Proceed, submit 2 copies of the testing, adjusting, and balancing strategies and step-by-step procedures as specified in Part 3 "Preparation" Article below. Include a complete set of report forms intended for use on this Project.

Certified Testing, Adjusting, and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.

Sample Report Forms: Submit 2 sets of sample testing, adjusting, and balancing report forms.

Warranty: Submit 2 copies of special warranty specified in the "Warranty" Article below.

QUALITY ASSURANCE:

Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by NEBB.

Testing, Adjusting, and Balancing Conference: Meet with the Owner's and the Architect's representatives on approval of the testing, adjusting, and balancing strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of testing, adjusting, and balancing team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days' advance

notice of scheduled meeting time and location.

- A. Agenda Items: Include at least the following:
 - 1. Submittal distribution requirements.
 - 2. Contract Documents examination report.
 - 3. Testing, adjusting, and balancing plan.
 - 4. Work schedule and Project site access requirements.
 - 5. Coordination and cooperation of trades and subcontractors.
 - 6. Coordination of documentation and communication flow.

Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:

- A. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
- B. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.

Testing, Adjusting, and Balancing Reports: Use standard forms from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

PROJECT CONDITIONS:

Full Owner Occupancy: The Owner will occupy the site and existing building during the entire testing, adjusting, and balancing period. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

COORDINATION:

Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.

Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.

Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

WARRANTY:

General Warranty: The national project performance guarantee 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.

Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:

- A. The certified Agent has tested and balanced systems according to the Contract Documents.
- B. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 PRODUCTS

CONTRACTORS:

Contractors: Subject to compliance with requirements, provide services by one of the following:

- A. Testing, Balancing and Controls:
 - 1. Allied Laboratories.
 - 2. QTAB.
 - 3. EMC2.
 - 4. Pro Balance.

PART 3 EXECUTION

EXAMINATION:

Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.

- A. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
- B. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

Examine approved submittal data of HVAC systems and equipment.

Examine project record documents described in Division 1 Section "Project Record Documents."

Examine Architect's and Engineer's design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

Examine equipment performance data, including fan and pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been

performed.

Examine system and equipment test reports.

Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible and their controls are connected and functioning.

Examine plenum ceilings, utilized for supply air, to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.

Examine strainers for clean screens and proper perforations.

Examine 3-way valves for proper installation for their intended function of diverting or mixing fluid flows.

Examine heat-transfer coils for correct piping connections and for clean and straight fins.

Examine open-piping-system pumps to ensure absence of entrained air in the suction piping.

Examine equipment for installation and for properly operating safety interlocks and controls.

Examine automatic temperature system components to verify the following:

- A. Dampers, valves, and other controlled devices operate by the intended controller.
- B. Dampers and valves are in the position indicated by the controller.
- C. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
- D. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
- E. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
- F. Sensors are located to sense only the intended conditions.
- G. Sequence of operation for control modes is according to the Contract Documents.
- H. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
- I. Interlocked systems are operating.
- J. Changeover from heating to cooling mode occurs according to design values.

Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

PREPARATION:

Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.

Complete system readiness checks and prepare system readiness reports. Verify the following:

- A. Permanent electrical power wiring is complete.
- B. Hydronic systems are filled, clean, and free of air.
- C. Automatic temperature-control systems are operational.
- D. Equipment and duct access doors are securely closed.
- E. Balance, smoke, and fire dampers are open.
- F. Isolating and balancing valves are open and control valves are operational.
- G. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
- H. Windows and doors can be closed so design conditions for system operations can be met.

GENERAL TESTING AND BALANCING PROCEDURES:

Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES:

Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

Prepare schematic diagrams of systems' "as-built" duct layouts.

For variable-air-volume systems, develop a plan to simulate diversity.

Determine the best locations in main and branch ducts for accurate duct airflow measurements.

Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

Verify that motor starters are equipped with properly sized thermal protection.

Check dampers for proper position to achieve desired airflow path.

Check for airflow blockages.

Check condensate drains for proper connections and functioning.

Check for proper sealing of air-handling unit components.

CONSTANT-VOLUME AIR SYSTEMS' BALANCING PROCEDURES:

The procedures in this Article apply to constant-volume supply-, return-, and exhaust-air systems. Additional procedures are required for variable-air-volume, multizone, dual-duct, induction-unit supply-air systems and process exhaust-air systems. These additional procedures are specified in other articles in this Section.

Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer.

- A. Measure fan static pressures to determine actual static pressure as follows:
 - 1. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
 - 2. Measure static pressure directly at the fan outlet or through the flexible connection.
 - 3. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
 - 4. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
- B. Measure static pressure across each air-handling unit component.
 - 1. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
- C. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers under final balanced conditions.
- D. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
- E. Adjust fan speed higher or lower than design with the approval of the Architect. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
- F. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.

Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.

- A. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
 - 1. Where sufficient space in submains and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
- B. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submains and branch ducts to design airflows within specified tolerances.

Measure terminal outlets and inlets without making adjustments.

- A. Measure terminal outlets using a direct-reading hood or the outlet manufacturer's written instructions and calculating factors.

Adjust terminal outlets and inlets for each space to design airflows within specified tolerances of design values. Make adjustments using volume dampers rather than extractors and the dampers at the air terminals.

- A. Adjust each outlet in the same room or space to within specified tolerances of design quantities without generating noise levels above the limitations prescribed by the Contract Documents.
- B. Adjust patterns of adjustable outlets for proper distribution without drafts.

VARIABLE-AIR-VOLUME SYSTEMS' ADDITIONAL PROCEDURES:

Compensating for Diversity: When the total airflow of all terminal units is more than the fan design airflow volume, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the design airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.

Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

- A. Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load.
- B. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge duct losses.
- C. Measure total system airflow. Adjust to within 10 percent of design airflow.
- D. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use the terminal unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
- E. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.
 1. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.
- F. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
- G. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure adequate static pressure is maintained at the most critical unit.
- H. Record the final fan performance data.

FUNDAMENTAL PROCEDURES FOR HYDRONIC SYSTEMS:

Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

Prepare schematic diagrams of systems' "as-built" piping layouts.

Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

- A. Open all manual valves for maximum flow.
- B. Check expansion tank liquid level.
- C. Check makeup-water-station pressure gage for adequate pressure for highest vent.
- D. Check flow-control valves for specified sequence of operation and set at design flow.
- E. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type, unless several terminal valves are kept open.
- F. Set system controls so automatic valves are wide open to heat exchangers.
- G. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
- H. Check air vents for a forceful liquid flow exiting from vents when manually operated.

HYDRONIC SYSTEMS' BALANCING PROCEDURES:

Determine water flow at pumps. Use the following procedures, except for positive-displacement pumps:

- A. Verify impeller size by operating the pump with the discharge valve closed. Verify with the pump manufacturer that this will not damage pump. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on the manufacturer's pump curve at zero flow and confirm that the pump has the intended impeller size.
- B. Check system resistance. With all valves open, read pressure differential across the pump and mark the pump manufacturer's head-capacity curve. Adjust pump discharge valve until design water flow is achieved.
- C. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on the pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
- D. Report flow rates that are not within plus or minus 5 percent of design.

Set calibrated balancing valves, if installed, at calculated presettings.

Measure flow at all stations and adjust, where necessary, to obtain first balance.

- A. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than design flow.

Adjust balancing stations to within specified tolerances of design flow rate as follows:

- A. Determine the balancing station with the highest percentage over design flow.
- B. Adjust each station in turn, beginning with the station with the highest percentage over design flow and proceeding to the station with the lowest percentage over design flow.
- C. Record settings and mark balancing devices.

Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures, including outdoor-air temperature.

Measure the differential-pressure control valve settings existing at the conclusions of balancing.

VARIABLE-FLOW HYDRONIC SYSTEMS' ADDITIONAL PROCEDURES:

Balance systems with automatic 2- and 3-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

PRIMARY-SECONDARY-FLOW HYDRONIC SYSTEMS' ADDITIONAL PROCEDURES:

Balance the primary system crossover flow first, then balance the secondary system.

MOTORS:

Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

- A. Manufacturer, model, and serial numbers.
- B. Motor horsepower rating.
- C. Motor rpm.
- D. Efficiency rating if high-efficiency motor.
- E. Nameplate and measured voltage, each phase.
- F. Nameplate and measured amperage, each phase.
- G. Starter thermal-protection-element rating.

Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

HEAT-TRANSFER COILS:

Water Coils: Measure the following data for each coil:

- A. Entering and leaving-water temperatures.
- B. Water flow rate.
- C. Water pressure drop.
- D. Dry-bulb temperatures of entering and leaving air.
- E. Wet-bulb temperatures of entering and leaving air for cooling coils designed for less than 7500 cfm (3540 L/s).
- F. Airflow.
- G. Air pressure drop.

TOLERANCES:

Set HVAC system airflow and water flow rates within the following tolerances:

- A. Supply, Return, and Exhaust Fans: Plus 5 to plus 10 percent.
- B. Air Outlets and Inlets: 0 to minus 10 percent.
- C. Heating-Water Flow Rate: 0 to minus 10 percent.
- D. Cooling-Water Flow Rate: 0 to minus 5 percent.

FINAL REPORT:

General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.

Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

- A. Include a list of the instruments used for procedures, along with proof of calibration.

Final Report Contents: In addition to the certified field report data, include the following:

- A. Pump curves.
- B. Fan curves.
- C. Manufacturers' test data.
- D. Field test reports prepared by system and equipment installers.
- E. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.

General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:

- A. Title page.
- B. Name and address of testing, adjusting, and balancing Agent.
- C. Project name.
- D. Project location.
- E. Architect's name and address.
- F. Engineer's name and address.
- G. Contractor's name and address.
- H. Report date.
- I. Signature of testing, adjusting, and balancing Agent who certifies the report.
- J. Summary of contents, including the following:
 - 1. Design versus final performance.
 - 2. Notable characteristics of systems.
 - 3. Description of system operation sequence if it varies from the Contract Documents.
- K. Nomenclature sheets for each item of equipment.
- L. Data for terminal units, including manufacturer, type size, and fittings.
- M. Notes to explain why certain final data in the body of reports vary from design values.
- N. Test conditions for fans and pump performance forms, including the following:
 - 1. Settings for outside-, return-, and exhaust-air dampers.
 - 2. Conditions of filters.
 - 3. Cooling coil, wet- and dry-bulb conditions.
 - 4. Face and bypass damper settings at coils.
 - 5. Fan drive settings, including settings and percentage of maximum pitch diameter.
 - 6. Inlet vane settings for variable-air-volume systems.
 - 7. Settings for supply-air, static-pressure controller.
 - 8. Other system operating conditions that affect performance.

System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:

- A. Quantities of outside, supply, return, and exhaust airflows.
- B. Water and steam flow rates.
- C. Duct, outlet, and inlet sizes.

- D. Pipe and valve sizes and locations.
- E. Terminal units.
- F. Balancing stations.

Air-Handling Unit Test Reports: For air-handling units with coils, include the following:

- A. Unit Data: Include the following:
 - 1. Unit identification.
 - 2. Location.
 - 3. Make and type.
 - 4. Model number and unit size.
 - 5. Manufacturer's serial number.
 - 6. Unit arrangement and class.
 - 7. Discharge arrangement.
 - 8. Sheave make, size in inches (mm), and bore.
 - 9. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).
 - 10. Number of belts, make, and size.
 - 11. Number of filters, type, and size.
- B. Motor Data: Include the following:
 - 1. Make and frame type and size.
 - 2. Horsepower and rpm.
 - 3. Volts, phase, and hertz.
 - 4. Full-load amperage and service factor.
 - 5. Sheave make, size in inches (mm), and bore.
 - 6. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).
- C. Test Data: Include design and actual values for the following:
 - 1. Total airflow rate in cfm (L/s).
 - 2. Total system static pressure in inches wg (Pa).
 - 3. Fan rpm.
 - 4. Discharge static pressure in inches wg (Pa).
 - 5. Filter static-pressure differential in inches wg (Pa).
 - 6. Preheat coil static-pressure differential in inches wg (Pa).
 - 7. Cooling coil static-pressure differential in inches wg (Pa).
 - 8. Heating coil static-pressure differential in inches wg (Pa).
 - 9. Outside airflow in cfm (L/s).
 - 10. Return airflow in cfm (L/s).
 - 11. Outside-air damper position.
 - 12. Return-air damper position.
 - 13. Vortex damper position.

Apparatus-Coil Test Reports: For apparatus coils, include the following:

- A. Coil Data: Include the following:
 - 1. System identification.
 - 2. Location.
 - 3. Coil type.
 - 4. Number of rows.
 - 5. Fin spacing in fins per inch (mm o.c.).
 - 6. Make and model number.
 - 7. Face area in sq. ft. (sq. m).
 - 8. Tube size in NPS (DN).
 - 9. Tube and fin materials.

10. Circuiting arrangement.

B. Test Data: Include design and actual values for the following:

1. Airflow rate in **cfm** (L/s).
2. Average face velocity in **fpm** (m/s).
3. Air pressure drop in **inches wg** (Pa).
4. Outside-air, wet- and dry-bulb temperatures in **deg F** (deg C).
5. Return-air, wet- and dry-bulb temperatures in **deg F** (deg C).
6. Entering-air, wet- and dry-bulb temperatures in **deg F** (deg C).
7. Leaving-air, wet- and dry-bulb temperatures in **deg F** (deg C).
8. Water flow rate in **gpm** (L/s).
9. Water pressure differential in **feet of head or psig** (kPa).
10. Entering-water temperature in **deg F** (deg C).
11. Leaving-water temperature in **deg F** (deg C).
12. Refrigerant expansion valve and refrigerant types.
13. Refrigerant suction pressure in **psig** (kPa).
14. Refrigerant suction temperature in **deg F** (deg C).
15. Inlet steam pressure in **psig** (kPa).

Fan Test Reports: For supply, return, and exhaust fans, include the following:

A. Fan Data: Include the following:

1. System identification.
2. Location.
3. Make and type.
4. Model number and size.
5. Manufacturer's serial number.
6. Arrangement and class.
7. Sheave make, size in **inches** (mm), and bore.
8. Sheave dimensions, center-to-center and amount of adjustments in **inches** (mm).

B. Motor Data: Include the following:

1. Make and frame type and size.
2. Horsepower and rpm.
3. Volts, phase, and hertz.
4. Full-load amperage and service factor.
5. Sheave make, size in **inches** (mm), and bore.
6. Sheave dimensions, center-to-center and amount of adjustments in **inches** (mm).
7. Number of belts, make, and size.

C. Test Data: Include design and actual values for the following:

1. Total airflow rate in **cfm** (L/s).
2. Total system static pressure in **inches wg** (Pa).
3. Fan rpm.
4. Discharge static pressure in **inches wg** (Pa).
5. Suction static pressure in **inches wg** (Pa).

Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

A. Report Data: Include the following:

1. System and air-handling unit number.
2. Location and zone.
3. Traverse air temperature in **deg F** (deg C).

4. Duct static pressure in **inches wg** (Pa).
5. Duct size in **inches** (mm).
6. Duct area in **sq. ft.** ((sq. m)).
7. Design airflow rate in **cfm** (L/s).
8. Design velocity in **fpm** (m/s).
9. Actual airflow rate in **cfm** (L/s).
10. Actual average velocity in **fpm** (m/s).
11. Barometric pressure in **psig** (Pa).

Air-Terminal-Device Reports: For terminal units, include the following:

- A. Unit Data: Include the following:
 1. System and air-handling unit identification.
 2. Location and zone.
 3. Test apparatus used.
 4. Area served.
 5. Air-terminal-device make.
 6. Air-terminal-device number from system diagram.
 7. Air-terminal-device type and model number.
 8. Air-terminal-device size.
 9. Air-terminal-device effective area in **sq. ft.** ((sq. m)).
- B. Test Data: Include design and actual values for the following:
 1. Airflow rate in **cfm** (L/s).
 2. Air velocity in **fpm** (m/s).
 3. Preliminary airflow rate as needed in **cfm** (L/s).
 4. Preliminary velocity as needed in **fpm** (m/s).
 5. Final airflow rate in **cfm** (L/s).
 6. Final velocity in **fpm** (m/s).
 7. Space temperature in **deg F** (deg C).

System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

- A. Unit Data: Include the following:
 1. System and air-handling unit identification.
 2. Location and zone.
 3. Room or riser served.
 4. Coil make and size.
 5. Flowmeter type.
- B. Test Data: Include design and actual values for the following:
 1. Airflow rate in **cfm** (L/s).
 2. Entering-water temperature in **deg F** (deg C).
 3. Leaving-water temperature in **deg F** (deg C).
 4. Water pressure drop in **feet of head or psig** (kPa).
 5. Entering-air temperature in **deg F** (deg C).
 6. Leaving-air temperature in **deg F** (deg C).

Pump Test Reports: For pumps, include the following data. Calculate impeller size by plotting the shutoff head on pump curves.

- A. Unit Data: Include the following:
 1. Unit identification.
 2. Location.

3. Service.
 4. Make and size.
 5. Model and serial numbers.
 6. Water flow rate in **gpm (L/s)**.
 7. Water pressure differential in **feet of head or psig (kPa)**.
 8. Required net positive suction head in **feet of head or psig (kPa)**.
 9. Pump rpm.
 10. Impeller diameter in **inches (mm)**.
 11. Motor make and frame size.
 12. Motor horsepower and rpm.
 13. Voltage at each connection.
 14. Amperage for each phase.
 15. Full-load amperage and service factor.
 16. Seal type.
- B. Test Data: Include design and actual values for the following:
1. Static head in **feet of head or psig (kPa)**.
 2. Pump shutoff pressure in **feet of head or psig (kPa)**.
 3. Actual impeller size in **inches (mm)**.
 4. Full-open flow rate in **gpm (L/s)**.
 5. Full-open pressure in **feet of head or psig (kPa)**.
 6. Final discharge pressure in **feet of head or psig (kPa)**.
 7. Final suction pressure in **feet of head or psig (kPa)**.
 8. Final total pressure in **feet of head or psig (kPa)**.
 9. Final water flow rate in **gpm (L/s)**.
 10. Voltage at each connection.
 11. Amperage for each phase.

Instrument Calibration Reports: For instrument calibration, include the following:

- A. Report Data: Include the following:
1. Instrument type and make.
 2. Serial number.
 3. Application.
 4. Dates of use.
 5. Dates of calibration.

END OF SECTION

23 07 13 DUCT INSULATION

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes semi-rigid and flexible duct, plenum, and breeching insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

Related Sections include the following:

- A. Division 7 Section "Firestopping" for firestopping materials and requirements for penetrations through fire and smoke barriers.
- B. Division 23 Section "Equipment Insulation" for insulation materials and application for pumps, tanks, hydronic specialties, and other equipment.
- C. Division 23 Section "Pipe Insulation" for insulation for piping systems.
- D. Division 23 Section "Metal Ducts" for duct liner.

SUBMITTALS:

Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

Shop Drawings: Show fabrication and installation details for the following:

- A. Removable insulation sections at access panels.
- B. Application of field-applied jackets.
- C. Applications at linkages for control devices.

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.

Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

QUALITY ASSURANCE:

Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

- A. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
- B. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed

rating of 150 or less.

DELIVERY, STORAGE, AND HANDLING:

Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

COORDINATION:

Coordinate clearance requirements with duct Installer for insulation application.

SCHEDULING:

Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 PRODUCTS**MANUFACTURERS:**

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Mineral-Fiber Insulation:
 - 1. CertainTeed Manson.
 - 2. Knauf FiberGlass GmbH.
 - 3. Owens-Corning Fiberglas Corp.
 - 4. John Manville.

INSULATION MATERIALS:

Mineral-Fiber Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

FIELD-APPLIED JACKETS:

General: ASTM C 921, Type 1, unless otherwise indicated.

Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

ACCESSORIES AND ATTACHMENTS:

Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).

- A. Tape Width: 4 inches (100 mm).

Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:

- A. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.
- B. Galvanized Steel: 0.005 inch (0.13 mm) thick.
- C. Aluminum: 0.007 inch (0.18 mm) thick.

Wire: 0.080-inch (2.0-mm), nickel-copper alloy; 0.062-inch (1.6-mm), soft-annealed, stainless steel; or 0.062-inch (1.6-mm), soft-annealed, galvanized steel.

Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated.

- A. Welded Pin Holding Capacity: 100 lb (45 kg) for direct pull perpendicular to the attached surface.

Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

- A. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 100 lb (45 kg) for direct pull perpendicular to the adhered surface.

Self-Adhesive Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

VAPOR RETARDERS:

Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 EXECUTION

EXAMINATION:

Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

Proceed with installation only after unsatisfactory conditions have been corrected.

PREPARATION:

Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

GENERAL APPLICATION REQUIREMENTS:

Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.

Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.

Use accessories compatible with insulation materials and suitable for the service. Use accessories

that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

Apply multiple layers of insulation with longitudinal and end seams staggered.

Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

Keep insulation materials dry during application and finishing.

Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

Apply insulation with the least number of joints practical.

Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.

Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

Apply insulation with integral jackets as follows:

- A. Pull jacket tight and smooth.
- B. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
- C. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.

Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.

Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.

- A. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
- B. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.

Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

- A. Seal penetrations with vapor-retarder mastic.
- B. Apply insulation for exterior applications tightly joined to interior insulation ends.
- C. Seal insulation to roof flashing with vapor-retarder mastic.

Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.

Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.

Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of

floor.

- A. For insulation indicated to have vapor retarders, taper termination and seal insulation ends with vapor-retarder mastic.

MINERAL-FIBER INSULATION APPLICATION:

Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.

- A. Apply adhesives according to manufacturer's recommended coverage rates per square foot.
- B. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
- C. Install anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - 1. On duct sides with dimensions 18 inches (450 mm) and smaller, along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
 - 2. On duct sides with dimensions larger than 18 inches (450 mm). Space 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
 - 3. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - 4. Do not overcompress insulation during installation.
- D. Impale insulation over anchors and attach speed washers.
- 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.
- F. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch (13-mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.
- G. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches (450 mm) o.c.
- H. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
- I. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- (150-mm-) wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches (150 mm) o.c.
- J. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

Board Applications for Ducts and Plenums: Secure board insulation with adhesive and anchor pins and speed washers.

- A. Apply adhesives according to manufacturer's recommended coverage rates per square foot.
- B. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
- C. Space anchor pins as follows:
 - 1. On duct sides with dimensions 18 inches (450 mm) and smaller, along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
 - 2. On duct sides with dimensions larger than 18 inches (450 mm). Space 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Apply

- additional pins and clips to hold insulation tightly against surface at cross bracing.
3. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 4. Do not overcompress insulation during installation.
- D. 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.
 - E. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch (13-mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.
 - F. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 - G. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- (150-mm-) wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches (150 mm) o.c.
 - H. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

FIELD-APPLIED JACKET APPLICATION:

Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

- A. Apply jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
- B. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of jacket manufacturer's recommended adhesive.
- C. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

DUCT SYSTEM APPLICATIONS:

Insulation materials and thicknesses are specified in schedules at the end of this Section.

Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.

Insulate the following plenums and duct systems:

- A. Indoor concealed supply-, return-, and outside-air ductwork.
- B. Indoor exposed supply-, return-, and outside-air ductwork.
- C. Outdoor exposed supply and return ductwork.
- D. Indoor exposed range-hood exhaust ductwork.
- E. Indoor concealed range-hood exhaust ductwork.
- F. Indoor exposed oven and dishwasher exhaust ductwork.
- G. Indoor concealed oven and dishwasher ductwork.

Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

- A. Fibrous-glass ducts.
- B. Metal ducts with duct liner.
- C. Factory-insulated flexible ducts.

- D. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
- E. Flexible connectors.
- F. Vibration-control devices.
- G. Testing agency labels and stamps.
- H. Nameplates and data plates.
- I. Access panels and doors in air-distribution systems.

INDOOR DUCT AND PLENUM APPLICATION SCHEDULE:

Service: Round, supply-air ducts, concealed.

- A. Material: Mineral-fiber blanket.
- B. Thickness: 1-1/2 inches (38 mm).
- C. Number of Layers: One.
- D. Field-Applied Jacket: Foil and paper.
- E. Vapor Retarder Required: Yes.

Service: Outside-air ducts.

- F. Material: Mineral-fiber board or mineral-fiber blanket.
- G. Thickness: 2 inches (50 mm).
- H. Number of Layers: One.
- I. Field-Applied Jacket: Foil and paper.
- J. Vapor Retarder Required: Yes.

Service: Rectangular, supply and return-air ducts, are to be lined.

END OF SECTION

23 07 19 PIPE INSULATION

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

Related Sections include the following:

- A. Division 33 Section "Hydronic Distribution" for loose-fill pipe insulation in underground piping outside the building.
- B. Division 7 Section "Firestopping" for firestopping materials and requirements for penetrations through fire and smoke barriers.
- C. Division 23 Section "Duct Insulation" for insulation for ducts and plenums.
- D. Division 23 Section "Equipment Insulation" for insulation materials and application for pumps, tanks, hydronic specialties, and other equipment.
- E. Division 23 Section "Hangers and Supports" for pipe insulation shields and protection saddles.

SUBMITTALS:

Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

Shop Drawings: Show fabrication and installation details for the following:

- A. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
- B. Attachment and covering of heat trace inside insulation.
- C. Insulation application at pipe expansion joints for each type of insulation.
- D. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
- E. Removable insulation at piping specialties and equipment connections.
- F. Application of field-applied jackets.

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.

Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

QUALITY ASSURANCE:

Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

- A. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
- B. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

DELIVERY, STORAGE, AND HANDLING:

Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

COORDINATION:

Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports."

Coordinate clearance requirements with piping Installer for insulation application.

Coordinate installation and testing of steam or electric heat tracing.

SCHEDULING:

Schedule insulation application after testing piping systems and, where required, after installing and testing heat-trace tape. Insulation application may begin on segments of piping that have satisfactory test results.

PART 2 PRODUCTS**MANUFACTURERS:**

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Mineral-Fiber Insulation:
 - 1. CertainTeed Manson.
 - 2. Knauf FiberGlass GmbH.
 - 3. Owens-Corning Fiberglas Corp.
 - 4. Schuller International, Inc.
- B. Flexible Elastomeric Thermal Insulation:
 - 1. Armstrong World Industries, Inc.
 - 2. Rubatex Corp.

INSULATION MATERIALS:

Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:

- A. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.
- B. Blanket Insulation: Comply with ASTM C 553, Type II, without facing.
- C. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:
 - 1. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
 - 2. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.

- D. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
- E. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
- F. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.
- G. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

- A. Adhesive: As recommended by insulation material manufacturer.
- B. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

FIELD-APPLIED JACKETS:

General: ASTM C 921, Type 1, unless otherwise indicated.

Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming.

- A. Adhesive: As recommended by insulation material manufacturer.
- B. PVC Jacket Color: White.

Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil- (0.5-mm) thick, high-impact, ultraviolet-resistant PVC.

- A. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
- B. Adhesive: As recommended by insulation material manufacturer.

Aluminum Jacket: Aluminum roll stock, ready for shop or field cutting and forming to indicated sizes. Comply with ASTM B 209 (ASTM B 209M), 3003 alloy, H-14 temper.

- A. Finish and Thickness: Stucco-embossed finish, 0.016 inch (0.40 mm) thick.
- B. Moisture Barrier: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.
- C. Elbows: Preformed, 45- and 90-degree, short- and long-radius elbows; same material, finish, and thickness as jacket.

ACCESSORIES AND ATTACHMENTS:

Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).

- A. Tape Width: 4 inches (100 mm).

Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:

- A. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.
- B. Galvanized Steel: 0.005 inch (0.13 mm) thick.
- C. Aluminum: 0.007 inch (0.18 mm) thick.
- D. Brass: 0.010 inch (0.25 mm) thick.
- E. Nickel-Copper Alloy: 0.005 inch (0.13 mm) thick.

Wire: 0.080-inch (2.0-mm), nickel-copper alloy; 0.062-inch (1.6-mm), soft-annealed, stainless steel; or 0.062-inch (1.6-mm), soft-annealed, galvanized steel.

VAPOR RETARDERS:

Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 EXECUTION

EXAMINATION:

Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

Proceed with installation only after unsatisfactory conditions have been corrected.

PREPARATION:

Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

GENERAL APPLICATION REQUIREMENTS:

Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.

Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

Apply multiple layers of insulation with longitudinal and end seams staggered.

Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

Keep insulation materials dry during application and finishing.

Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

Apply insulation with the least number of joints practical.

Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

- A. Apply insulation continuously through hangers and around anchor attachments.
- B. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- C. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
- D. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

Apply adhesives and mastics at the manufacturer's recommended coverage rate.

Apply insulation with integral jackets as follows:

- A. Pull jacket tight and smooth.
- B. Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.
- C. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply 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 (100 mm) o.c.
 - 1. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
- D. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
- E. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

- A. Seal penetrations with vapor-retarder mastic.
- B. Apply insulation for exterior applications tightly joined to interior insulation ends.
- C. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
- D. Seal metal jacket to roof flashing with vapor-retarder mastic.

Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.

Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.

- A. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Firestopping."

Floor Penetrations: Apply insulation continuously through floor assembly.

- A. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

MINERAL-FIBER INSULATION APPLICATION:

Apply insulation to straight pipes and tubes as follows:

- A. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
- B. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet (4.5 to 6 m) to form a vapor retarder between pipe insulation segments.
- C. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
- D. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

Apply insulation to flanges as follows:

- A. Apply preformed pipe insulation to outer diameter of pipe flange.
- B. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
- C. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
- D. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

Apply insulation to fittings and elbows as follows:

- A. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
- B. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
- C. Cover fittings with standard PVC fitting covers.
- D. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch (25 mm) at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

Apply insulation to valves and specialties as follows:

- A. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
- B. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.

- C. Apply insulation to flanges as specified for flange insulation application.
- D. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
- E. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
- F. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION:

Apply insulation to straight pipes and tubes as follows:

- A. Follow manufacturer's written instructions for applying insulation.
- B. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

Apply insulation to flanges as follows:

- A. Apply pipe insulation to outer diameter of pipe flange.
- B. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
- C. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of the same thickness as pipe insulation.
- D. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

Apply insulation to fittings and elbows as follows:

- A. Apply mitered sections of pipe insulation.
- B. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

Apply insulation to valves and specialties as follows:

- A. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
- B. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to strainer basket.
- C. Apply insulation to flanges as specified for flange insulation application.
- D. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

FIELD-APPLIED JACKET APPLICATION:

Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

- A. Apply jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
- B. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of jacket manufacturer's recommended adhesive.

- C. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

Foil and Paper Jackets: Apply foil and paper jackets where indicated.

- A. Draw jacket material smooth and tight.
- B. Apply lap or joint strips with the same material as jacket.
- C. Secure jacket to insulation with manufacturer's recommended adhesive.
- D. Apply jackets with 1-1/2-inch (40-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
- E. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.

Apply PVC jacket on exposed piping in finished spaces, up to 12'-0" above finished floor, with 1-inch (25-mm) overlap at longitudinal seams and end joints, except for mechanical rooms. Seal with manufacturer's recommended adhesive.

Apply metal jacket where indicated, with 2-inch (50-mm) 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 (300 mm) o.c. and at end joints.

FINISHES:

Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Division 9 Section "Painting."

Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of the insulation manufacturer's recommended protective coating.

Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

PIPING SYSTEM APPLICATIONS:

Insulation materials and thicknesses are specified in schedules at the end of this Section.

Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

- A. Flexible connectors.
- B. Vibration-control devices.
- C. Fire-suppression piping.
- D. Drainage piping located in crawl spaces, unless otherwise indicated.
- E. Below-grade piping, unless otherwise indicated.
- F. Chrome-plated pipes and fittings, unless potential for personnel injury.
- G. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

FIELD QUALITY CONTROL:

Insulation applications will be considered defective if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.

Reinstall insulation and covers on fittings and valves uncovered for inspection according to these Specifications.

INSULATION APPLICATION SCHEDULE, GENERAL:

Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.

Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

INTERIOR INSULATION APPLICATION SCHEDULE:

Service: Refrigerant suction and hot-gas piping.

- A. Operating Temperature: 35 to 50 deg F (2 to 10 deg C).
- B. Insulation Material: Mineral fiber or flexible elastomeric.
- C. Insulation Thickness: $\frac{3}{4}$ inch.
- A. Field-Applied Jacket: PVC in exposed finished rooms up to 12 feet above finished floor.
- D. Vapor Retarder Required: Yes.
- E. Finish: Painted.

Service: Heating hot-water supply and return.

- A. Operating Temperature: 100 to 200 deg F (38 to 93 deg C).
- B. Insulation Material: Mineral fiber.
- C. Insulation Thickness: Apply the following insulation thicknesses:
 - 1. NPS 2" pipe and smaller: 1 inch.
 - 2. NPS 2-1/2" pipe and larger: 1-1/2 inch.
- B. Field-Applied Jacket: PVC in exposed finished rooms up to 12 feet above finished floor.
- D. Vapor Retarder Required: Yes.
- E. Finish: None.

Service: Chilled-water supply and return.

- A. Operating Temperature: 35 to 75 deg F (2 to 24 deg C).
- B. Insulation Material: Mineral fiber.
- C. Insulation Thickness: Apply the following insulation thicknesses:
 - 1. NPS 1-1/2 pipe and smaller: 1-1/2 inch.
 - 2. NPS 2 and larger: 2 inch.
- D. Field-Applied Jacket: PVC in exposed finished rooms.
- E. Vapor Retarder Required: Yes.
- F. Finish: None.

EXTERIOR INSULATION APPLICATION SCHEDULE:

This application schedule is for aboveground insulation outside the building.

Service: Refrigerant suction.

- A. Operating Temperature: 35 to 50 deg F (2 to 10 deg C).
- B. Insulation Material: Flexible elastomeric.
- C. Insulation Thickness: $\frac{3}{4}$ inch.
- D. Field-Applied Jacket: Aluminum or VentureClad Plus (or equal), 13 ply, self adhesive jacket with white stucco embossed finish.

- E. Vapor Retarder Required: Yes.
- F. Finish: Painted.

Service: Chilled-water supply and return.

- A. Operating Temperature: 35 to 75 deg F (2 to 24 deg C).
- B. Insulation Material: Flexible elastomeric.
- C. Insulation Thickness: 1 inch, 2 layers (total 2 inch thickness).
- D. Field-Applied Jacket: Aluminum or VentureClad Plus (or equal), 13 ply, self adhesive jacket with white stucco embossed finish.
- E. Vapor Retarder Required: Yes.
- F. Finish: None.

END OF SECTION

23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

Related Sections include the following:

- A. Division 26 Section "Fire Alarm" for fire and smoke detectors mounted in HVAC systems and equipment.
- A. Division 23 Section "Hydronic Piping."
- B. Division 23 Section "Air Terminals."
- C. Division 26 Section "Electrical Power Monitoring and Control."

DEFINITIONS:

ASC: Application Specific Controllers.

BAS: Building Automation System.

DDC: Direct-digital controls.

LAN: Local area network.

MS/TP: Master-slave/token-passing.

PICS: Protocol Implementation Conformance Statement.

MCU: Main Control Unit.

SYSTEM DESCRIPTION:

The system shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices.

System architecture shall eliminate dependence upon any single device for alarm reporting and control execution. Each controller shall operate independently by performing specified control, alarm management and data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

SUBMITTALS:

Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

Each control device labeled with setting or adjustable range of control.

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.

- A. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
- B. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
- C. Details of control panel faces, including controls, instruments, and labeling.
- D. Written description of sequence of operation.
- E. Schedule of dampers including size, leakage, and flow characteristics.
- F. Schedule of valves including leakage and flow characteristics.
- G. Trunk cable schematic showing programmable control unit locations and trunk data conductors.
- H. Listing of connected data points, including connected control unit and input device.
- I. System graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.
- J. System configuration showing peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.

Software and Firmware Operational Documentation: Include the following:

- A. Software operating and upgrade manuals.
- B. Program Software Backup: On a magnetic media or compact disc, complete with data files.
- C. Device address list.
- D. Printout of software application and graphic screens.
- E. Software license required by and installed for DDC workstations and control systems.

Software Upgrade Kit: For Owner to use in modifying software to suit future power system revisions or monitoring and control revisions.

Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

Maintenance Data: For systems to include in maintenance manuals specified in Division 1. Include the following:

- A. Maintenance instructions and lists of spare parts for each type of control device.
- B. Interconnection wiring diagrams with identified and numbered system components and devices.
- C. Keyboard illustrations and step-by-step procedures indexed for each operator function.
- D. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
- E. Calibration records and list of set points.

Qualification Data: For firms and persons specified in "Quality Assurance" Article.

QUALITY ASSURANCE:

Installer Qualifications: An experienced installer who is a certified installer of the automatic control system manufacturer for both installation and maintenance of units required for this Project.

Manufacturer Qualifications: A firm experienced in manufacturing automatic temperature-control systems similar to those indicated for this Project and with a record of successful in-service performance.

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.

All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Section 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

Comply with UL 916 PAZX and 864 UDTZ and be so listed.

Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."

Comply with ASHRAE 135 for DDC system control components.

DELIVERY, STORAGE, AND HANDLING:

Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to unit manufacturer.

COORDINATION:

Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

Coordinate equipment with Division 26 Section "Fire Alarm" to achieve compatibility with equipment that interfaces with that system.

Coordinate supply of conditioned electrical circuits for control units and operator workstation.

Coordinate equipment with Division 26 Section "Panelboards" to achieve compatibility with starter coils and annunciation devices.

Coordinate equipment with Division 26 Section "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.

Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Control Systems:
 - 1. Siemens (BCS).

DDC EQUIPMENT:

Application Software: Include the following:

- A. Input/output capability from operator station.

- B. Operator system access levels via software password, minimum 4 levels.
- C. Database creation and support.
- D. Dynamic color graphic displays.
- E. Alarm processing.
- F. Event processing.
- G. Automatic restart of field equipment on restoration of power.
- H. Data collection.
- I. Graphic development on workstation.
- J. Maintenance management.

Main Control Units: Stand-alone Controllers shall be microprocessor-based with a minimum word size of 16 bits. They shall also be multi-tasking, multi-user, real-time digital control processors consisting of processors, communication controllers, power supplies and optional input/output point modules. Controller size shall be sufficient to fully meet the requirements of this specification and the attached point list.

Each Main Controller shall have sufficient memory, a minimum of 1 megabyte, to support its own operating system and databases, including:

- A. Control processes
- B. Energy management applications
- C. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
- D. Historical/trend data for points specified
- E. Maintenance support applications
- F. Custom processes
- G. Operator I/O
- H. Dial-up communications
- I. Manual override monitoring

Provide sufficient internal memory for the specified control sequences and have at least 25% of the memory available for future use.

Main Controllers with point termination capability shall have a minimum of 10 per cent spare capacity for future point connection. The type of spares shall be in the same proportion as the implemented I/O functions of the panel, but in no case shall there be less than two spares of each implemented I/O type. Provide all processors, power supplies and communication controllers complete so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring.

Main Controllers shall provide at least two data communication ports for operation of operator I/O devices such as operator terminals, modems and portable laptop operator's terminals. Main Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers or terminals.

Main Controllers with point termination capability, the operator shall have the ability to manually override automatic or centrally executed commands at the Main Controller via local, point discrete, internally mounted on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.

Main Controllers without point termination capability shall have a integral keypad and display for local override and operating changes. All passwords and priority levels that exist at the workstation level shall apply.

Main Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. Main Controllers shall also collect override activity information for reports.

Each Main Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The Main Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.

Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standards 587-1980.

In the event of the loss of normal power, there shall be an orderly shutdown of all Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

Upon restoration of normal power, the Controller shall automatically resume full operation without manual intervention.

Should Main Controller memory be lost for any reason, the user shall have the capability of reloading the Main Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.

Application Specific Controllers: Each Main Controller shall be able to extend its performance and capacity through the use of remote application specific controllers (ASCs).

Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor.

Controllers shall include all point inputs and outputs necessary to perform the specified control sequences for its respective piece of equipment. Analog outputs shall be industry standard signals such as 24V floating control, allowing for interface to a variety of modulating actuators. Refer to controls schematic layout and points list. Terminal equipment controllers utilizing proprietary control signals and actuators shall not be acceptable. As an alternative, provide Main Controllers or other ASCs with industry standard outputs for control of all terminal equipment.

The Contractor has the option of providing point termination of boiler plants, chiller plants and VAV AHU's either at a Main Controller or with an ASC. If an ASC is utilized for termination provide either point discrete hand/off/auto switches within the ASC or a keypad and display integral with ASC must be provided for manual override capability.

Controllers utilized for boiler plants, chiller plants, and AHU's shall have a minimum 10 percent spare capacity for future point connection. The type of spares shall be in the same proportion as the implemented I/O functions of the panel, but in no case shall there be less than two spares of each implemented I/O type. Provide all accessories, power supplies and communication controllers complete so that the implementation of a point only requires the addition of the appropriate point input/output termination and wiring. Spare points shall be provided per controller(s) for each piece of equipment. Providing a spare controller to accommodate the spare capacity of multiple pieces of equipment is not acceptable.

Each controller performing space temperature control shall be provided with a matching room

temperature sensor.

Each controller shall perform its primary control function independent of other Main Controller LAN communication, or if LAN communication is interrupted. Reversion to a fail-safe mode of operation during LAN interruption is not acceptable. The controller shall receive its real-time data from the Main Controller time clock to insure LAN continuity. Each controller shall include algorithms incorporating proportional, integral and derivative (PID) gains for all applications. All PID gains and biases shall be field-adjustable by the user via terminals as specified herein. This functionality shall allow for tighter control of space conditions and shall facilitate optimal occupant comfort and energy savings. Controllers that incorporate proportional and integral (PI) control algorithms only shall not be acceptable.

Provide each ASC with sufficient memory to accommodate point databases, operating programs, local alarming and local trending. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM, or minimum of 72-hour battery backup shall be provided. The controllers shall be able to return to full normal operation without user intervention after a power failure of unlimited duration. Operating programs shall be field-selectable for specific applications. In addition, specific applications may be modified to meet the user's exact control strategy requirements, allowing for additional system flexibility. Controllers that require factory changes of all applications are not acceptable.

LANs: Capacity for a minimum of 10 workstations connected to multiuser, multitasking environment with concurrent capability to access DDC network or control units. A maximum of 75% of any LAN may be configured for Main Control Units, ASC's, or workstations to insure adequate global data and alarm response times and expansion of controllers without additional hardware.

- A. Media: Ethernet, peer-to-peer CMA/CD, operating at 10 Mbps.
- B. Media: ARCNET (attached resources computer network), peer to peer, operating at 2.5 Mbps.
- C. Media: MS/TP, EIA 485, operating at 76.8 kBps.

Software: Update to latest version of software at Project completion. Include and implement the following capabilities from the control units:

The MCU shall have the ability to perform the following pre-tested control algorithms:

- A. Two-position control
- B. Proportional control
- C. Proportional plus integral control
- D. Proportional, integral, plus derivative control
- E. Control loop tuning

Control software shall include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period.

The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.

Upon the resumption of normal power, each MCU shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling and turn equipment on or off as necessary to resume normal operations.

Main Controllers shall have the ability to perform any or all the following energy management routines:

- A. Time-of-day scheduling
- B. Calendar-based scheduling
- C. Holiday scheduling
- D. Temporary schedule overrides
- E. Start-Stop Time Optimization
- F. Automatic Daylight Savings Time Switchover
- G. Night setback control
- H. Enthalpy switchover (economizer)
- I. Peak demand limiting
- J. Temperature-compensated duty cycling
- K. Fan speed/CFM control
- L. Heating/cooling interlock
- M. Hot water reset
- N. Chilled water reset

All programs shall be executed automatically without the need for operator intervention and shall be flexible enough to allow user customization. Programs shall be applied to building equipment as described in the Sequence of Operations.

Main Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.

It shall be possible to use any of the following in a custom process:

- A. Any system measured point data or status
- B. Any calculated data
- C. Any results from other processes
- D. User-defined constants
- E. Arithmetic functions (+, -, *, /, square root, exp, etc.)
- F. Boolean logic operators (and/or, exclusive or, etc.)
- G. On-delay/off-delay/one-shot timers

Custom processes may be triggered based on any combination of the following:

- A. Time interval
- B. Time-of-day
- C. Date
- D. Other processes
- E. Time programming
- F. Events (e.g., point alarms)

A single process shall be able to incorporate measured or calculated data from any and all other Controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other Controllers on the network.

Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a printer or pager.

The custom control programming feature shall be documented via English language descriptors.

In addition to the point's descriptor and the time and date, the user shall be able to print, display

or store a 200 character alarm message to more fully describe the alarm condition or direct operator response.

Each MCU shall be capable of storing a library of at least 50 alarm messages. Each message may be assignable to any number of points in the Controller.

In dial-up applications, operator-selected alarms shall initiate a call to a remote operator device.

A variety of historical data collection utilities shall be provided to manually or automatically sample, store and display system data for points as specified in the I/O summary.

Main Controllers shall store point history data for selected analog and digital inputs and outputs:

- A. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each Main Controllers point group. Two methods of collection shall be allowed: either by a pre-defined time interval or upon a pre-defined change of value. Sample intervals of 1 minute to 7 days shall be provided. Each Main Controller shall have a dedicated RAM-based buffer for trend data and shall be capable of storing a minimum of 25,000 data samples.
- B. Trend data shall be stored at the Main Controllers and uploaded to the workstation when retrieval is desired. Uploads shall occur based upon either user-defined interval, manual command or when the trend buffers are full. All trend data shall be available for use in 3rd party personal computer applications.
- C. Provide high resolution sampling capability for verification of control loop performance. Operator-initiated automatic and manual loop tuning algorithms shall be provided for operator-selected PID control loops as identified in the point I/O summary. Provide capability to view or print trend and tuning reports.
- D. Loop tuning shall be capable of being initiated either locally at the Main Controller, from a network workstation or remotely using dial-in modems. For all loop tuning functions, access shall be limited to authorized personnel through password protection.

Main Controllers shall automatically accumulate and store run-time hours for digital input and output points as specified in the point I/O summary.

The totalization routine shall have a sampling resolution of one minute or less.

The user shall have the ability to define a warning limit for run-time totalization. Unique, user-specified messages shall be generated when the limit is reached.

Main Controllers shall automatically sample, calculate and store consumption totals on a daily, weekly or monthly basis for user-selected analog and digital pulse input type points as specified in the point I/O summary.

Totalization shall provide calculation and storage of accumulations of up to 99,999.9 units (e.g., KWH, gallons, BTU, tons, etc.).

CONTROL PANELS:

Control Panels: Unitized cabinet with suitable brackets for wall or floor mounting, located adjacent to each system under automatic control. Provide common keying for all panels.

- A. Fabricate panels of **0.06-inch- (1.5-mm-)** thick, furniture-quality steel, or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish.

- B. Panel-Mounted Equipment: Temperature and humidity controllers, relays, and automatic switches; except safety devices. Mount devices with adjustments accessible through front of panel.
- C. Door-Mounted Equipment: Flush-mount (on hinged door) manual switches, including damper-positioning switches, changeover switches, thermometers, and gages.
- D. Graphics: Color-coded graphic, laminated-plastic displays on doors, schematically showing system being controlled, with protective, clear plastic sheet bonded to entire door.

ANALOG CONTROLLERS:

Step Controllers: Six- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.

Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F (minus 23 to plus 21 deg C), and single- or double-pole contacts.

Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.

- A. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.

Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.

Receiver Controllers: Single- or multiple-input models with control-point adjustment, direct or reverse acting with mechanical set-point adjustment with locking device, proportional band adjustment, authority adjustment, and proportional control mode.

- A. Remote-control-point adjustment shall be plus or minus 20 percent of sensor span, input signal of 3 to 13 psig (21 to 90 kPa).
- B. Proportional band shall extend from 2 to 20 percent for 5 psig (34 kPa).
- C. Authority shall be 20 to 200 percent.
- D. Air-supply pressure of 18 psig (124 kPa), input signal of 3 to 15 psig (21 to 103 kPa), and output signal 0 to supply pressure.
- E. Gages: 2-1/2 inches (64 mm) in diameter, 2.5 percent wide-scale accuracy, and range to match transmitter input or output pressure.

SENSORS:

Electronic Sensors: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

- A. Thermistor temperature sensors as follows:
 - 1. Accuracy: Plus or minus 0.5 deg F (0.3 deg C) at calibration point.
 - 2. Wire: Twisted, shielded-pair cable.
 - 3. Insertion Elements in Ducts: Single point, 8 inches (20 cm) long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (1 sq. m).

4. Averaging Elements in Ducts: Minimum 36 inches (91 cm) long, flexible; use where prone to temperature stratification or where ducts are larger than 9 sq. ft. (1 sq. m); length as required.
 5. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches (64 mm).
 6. Room Sensors: Match room thermostats, locking cover.
 7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
- B. Resistance Temperature Detectors: Platinum.
1. Accuracy: Plus or minus 0.2 percent at calibration point.
 2. Wire: Twisted, shielded-pair cable.
 3. Insertion Elements in Ducts: Single point, 8 inches (20 cm) long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (1 sq. m).
 4. Averaging Elements in Ducts: Minimum 36 inches (91 cm) long, flexible; use where prone to temperature stratification or where ducts are larger than 9 sq. ft. (1 sq. m); length as required.
 5. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches (64 mm).
 6. Room Sensors: Match room thermostats, locking cover.
 7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
- C. Humidity Sensors: Bulk polymer sensor element.
1. Accuracy: 5 percent full range with linear output.
 2. Room Sensors: With locking cover matching room thermostats, span of 25 to 90 percent relative humidity.
 3. Duct and Outside-Air Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.
- D. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
1. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
 2. Output: 4 to 20 mA.
 3. Building Static-Pressure Range: 0 to 0.25 inch wg (0 to 62 Pa).
 4. Duct Static-Pressure Range: 0 to 5 inches wg (0 to 1243 Pa).
- E. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; proportional output 4 to 20 mA.

Equipment operation sensors as follows:

- A. Status Inputs for Electric Motors: Current-sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

Electronic Valve/Damper Position Indication: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

Water-Flow Switches: Pressure-flow switches of bellows-actuated mercury or snap-acting type, with appropriate scale range and differential adjustment. For chilled-water applications, provide vaporproof type.

THERMOSTATS:

The sensor may be either RTD or thermistor type providing the following minimum performance

requirements are met:

- A. Accuracy: $\pm 1^{\circ}\text{F}$ ($\pm 0.6^{\circ}\text{C}$)
- B. Operating Range: 35° to 115°F (2° to 46°)
- C. Set Point Adjustment Range: 55° to 95°F (2° to 30°C)
- D. Set Point Modes: Independent Heating, Cooling, Night Setback-Heating, Night Setback-cooling
- E. Calibration Adjustments: None required
- F. Installation: Up to 100' from controller

Each room temperature sensor shall include a terminal jack integral to the sensor assembly. The terminal jack shall be used to connect a portable operator's terminal to control and monitor all hardware and software points associated with the controller. In lieu of an internal jack, provide a separate terminal jack mounted on a stainless steel wall plate adjacent to the sensor to facilitate direct access to the controller via the terminal.

Each room sensor shall also include the following auxiliary devices:

- A. Setpoint Adjustment
- B. Digital Temperature Indicator
- C. Override Button

The setpoint adjustment shall allow for modification of the temperature by the occupant. Setpoint adjustment may be locked out, overridden or limited as to time or temperature through software by an authorized operator at the central workstation, Main Controller, or via the portable operator's terminal.

An override switch shall initiate override of the night setback mode to normal (day) operation when activated by the occupant. The override function may be locked out, overridden or limited as to the time through software by an authorized operator at the central workstation, Main Controller or via the portable operator's terminal.

Rooms such as restrooms, hallways, vestibules, gymnasiums, and commons (public spaces) are to be provided with a flush mounted thermostat for vandal protection. Thermostat is to be recessed in a standard 2x4 electrical box with a stainless steel cover.

Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater.

Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature, with copper capillary and bulb, unless otherwise indicated.

- A. Bulbs in water lines with separate wells of same material as bulb.
- B. Bulbs in air ducts with flanges and shields.
- C. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit, adequately supported.
- D. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
- E. On-Off Thermostat: With precision snap switches, with electrical ratings required by application.
- F. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.

Room Thermostat Cover Construction: Manufacturer's standard locking covers.

- A. Set-Point Adjustment: Concealed.
- B. Set-Point Indication: Concealed.
- C. Thermometer: Concealed.
- D. Color: Standard manufacturer's color.
- E. Orientation: Vertical.

Room thermostat accessories include the following:

- A. Insulating Bases: For thermostats located on exterior walls.
- B. Thermostat Guards: Locking; heavy-duty, transparent plastic; mounted on separate base, where indicated.
- C. Adjusting Key: As required for calibration and cover screws.
- D. Aspirating Boxes: For flush-mounted aspirating thermostats.
- E. Set-Point Adjustment: diameter, adjustment knob.

Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable set point.

Airstream Thermostats: Two-pipe, fully proportional, single-temperature type, with adjustable set point in middle of range and adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.

Electric Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, automatic-reset switch that trips if temperature sensed across any **12 inches (300 mm)** of bulb length is equal to or below set point.

- A. Bulb Length: Minimum **20 feet (6 m)**.
- B. Quantity: One thermostat for every **20 sq. ft. (2 sq. m)** of coil surface.

ACTUATORS:

Manufacturers:

- A. Professional Series
- B. Belimo
- C. Invensys.

Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

- A. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
- B. Nonspring-Return Motors for Valves Larger Than **NPS 2-1/2 (DN 65)**: Size for running torque of **150 in. x lbf (16.9 N x m)** and breakaway torque of **300 in. x lbf (33.9 N x m)**.
- C. Spring-Return Motors for Valves Larger Than **NPS 2-1/2 (DN 65)**: Size for running and breakaway torque of **150 in. x lbf (16.9 N x m)**.
- D. Nonspring-Return Motors for Dampers Larger Than **25 Sq. Ft. (2.3 sq. m)**: Size for running torque of **150 in. x lbf (16.9 N x m)** and breakaway torque of **300 in. x lbf (33.9 N x m)**.
- E. Spring-Return Motors for Dampers Larger Than **25 Sq. Ft. (2.3 sq. m)**: Size for running and breakaway torque of **150 in. x lbf (16.9 N x m)**.

Electronic Damper / Large-Valve Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

- A. Valves: Size for torque required for valve close-off at maximum pump differential pressure.
- B. Dampers: Size for running torque calculated as follows:
 - 1. Parallel-Blade Damper with Edge Seals: 7 inch-pounds/sq. ft. (86.8 kg-cm/sq. m) of damper.
 - 2. Opposed-Blade Damper with Edge Seals: 5 inch-pounds/sq. ft. (62 kg-cm/sq. m) of damper.
 - 3. Dampers with 2 to 3 Inches wg (500 to 750 Pa) of Pressure Drop or Face Velocities of 1000 to 2500 FPM (5 to 13 m/s): Multiply the minimum full-stroke cycles above by 1.5.
 - 4. Dampers with 3 to 4 Inches wg (750 to 1000 Pa) of Pressure Drop or Face Velocities of 2500 to 3000 FPM (13 to 15 m/s): Multiply the minimum full-stroke cycles above by 2.0.
- C. Coupling: V-bolt and V-shaped, toothed cradle.
- D. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
- E. 100% surplus power to move the actuator from full open to full closed travel.
- F. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on non-spring-return actuators.
- G. Power Requirements (Two-Position Spring Return): 24-V ac.
- H. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
- I. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
- J. Temperature Rating: Minus 22 to plus 122 deg F (minus 30 to plus 50 deg C).
- K. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F (minus 30 to plus 121 deg C).
- L. Run Time: 30 seconds.
- M. Listed under UL Standard 873 and manufactured under ISO 9001.
- N. 2-year manufacturer's warranty, starting at date of substantial completion.

CONTROL VALVES:

Manufacturers:

- A. Siemens.
- B. Belimo.

Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated. Valves to be installed in an upright position.

Globe Valves NPS 2 (DN 50) and Smaller: Bronze body, bronze or stainless steel trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.

Globe Valves NPS 2-1/2 (DN 65) and Larger: Iron body, bronze or stainless steel trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.

Hydronic system globe valves shall have the following characteristics:

- A. Rating: Class 125 for service at 125 psig (862 kPa) and 250 deg F (121 deg C) operating conditions.
- B. Internal Construction: Replaceable plugs and seats of stainless steel or brass.
 - 1. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom of guided plugs.
 - 2. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom of guided plugs.
- C. Sizing: 5-psig (35-kPa) maximum pressure drop at design flow rate.
- D. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics. Operators shall close valves against pump shutoff head.

Pressure Independent Control Valves (All chilled water valves): Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

Manufacturers:

- A. Bell & Gossett.
- B. TA Hydronics.
- C. Griswold.
- D. Siemens.
- E. Honeywell.
- F. Johnson Controls.

Components:

- A. Pressure Independent Control Valve\Flow Limiter
 - 1. The 1/2"-1-1/4" Model PVC, Model AU, and Model AX valve bodies shall be constructed out of brass and rated for 360 PSIG working pressure.
 - 2. The 1-1/2" - 2" Model PVL valve bodies shall be constructed out of ductile iron and rated for 360 PSIG working pressure.
 - 3. The 2-1/2" - 6" Model PVL valve bodies shall be flanged, constructed out of ductile iron and rated for 175 PSIG or 360 PSIG working pressure.
 - 4. The valve bodies shall be rated for fluid temperatures 32°F (0°C) to 248°F (120°C) and ambient temperatures 34°F (1°C) to 122°F (50°C).
 - 5. The Model AU valve body shall have an integral isolation valve with stainless steel ball and stem with integrated pressure\temperature port and another pressure\temperature port located on the body itself.
 - 6. The Model AU valve body shall have the ability to accommodate a Union ended tailpiece that can connect to copper, male NPT piping, and female NPT connections and a union nut that can secure the tailpiece to the body of the valve to create a water-tight seal.
 - 7. The Model PVC, Model PVL and Model AX valve bodies shall include two pressure pressure\temperature ports.
 - 8. The Model AX, size 1/2" -1-1/4" valve bodies, shall have a separate attached male NPT x Female NPT, brass body, isolation valve equipped with chrome plated brass ball.
 - 9. The valve assembly shall include a field adjustable, lockable dial that shall have the flow rate setting with gallons per minute printed on it.
 - 10. The valve assembly shall provide 100% authority at all times.
 - 11. The valve assembly shall provide full stroke control regardless of the GPM setting on the dial.
 - 12. The valve assembly shall contain a stainless steel stem and spring.

13. If no actuator is used, the valve can be utilized as a pressure independent flow limiter.
14. The valve bodies close off\leakage rate shall meet an ANSI Class IV Shut off rating of ≤ 60 PSID (≤ 140 PSID as a flow limiter only; no actuator used).
15. The valve shall be within $\pm 5\%$ of set GPM within the valve's operating range.
16. Accessories:
 - a. Extended pressure/temperature ports.
 - b. Extended handle.

Butterfly Valves: 200-psig (1380-kPa), 150-psig (1035-kPa) maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.

- A. Body Style: Wafer or Grooved.
- B. Disc Type: Nickel-plated ductile iron, elastomer-coated ductile iron or epoxy-coated ductile iron.
- C. Sizing: 1-psig (7-kPa) maximum pressure drop at design flow rate.

Terminal Unit Control Valves: Bronze body, bronze trim, two- or three-port as indicated, replaceable plugs and seats, union and threaded ends.

- A. Rating: Class 125 for service at 125 psig (862 kPa) and 250 deg F (121 deg C) operating conditions.
- B. Sizing: 5-psig (35-kPa) maximum pressure drop at design flow rate, to close against pump shutoff head.
- C. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

DAMPERS:

Dampers: AMCA-rated, parallel-blade design, unless noted otherwise; 0.1084-inch (2.8-mm) minimum, galvanized-steel frames with holes for duct mounting; damper blades shall not be less than 0.0635-inch (1.6-mm) galvanized steel with maximum blade width of 8 inches (203 mm).

- A. Blades shall be secured to 1/2-inch- (13-mm-) 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.
- B. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).
- C. Low-leakage design with inflatable seal blade edging, or replaceable rubber seals, rated for leakage at less than 10 cfm per sq. ft. (51 L/s per sq. m) of damper area, at differential pressure of 4 inches wg (995 Pa) when damper is being held by torque of 50 in. x lbf (5.6 N x m); when tested according to AMCA 500D.

CONTROL CABLE:

All input and output control wiring to the control units shall be twisted and shielded cable. All shield to be grounded at the control panel, shields at the sensors or transducers to be folded back and taped.

All cable splices shall have joints soldered and taped including the shield. Mechanical connections will not be acceptable.

No digital input or output points shall be more than 250' from its respective controller.

All wiring within the panels must be made with connectors of appropriate size and design for the terminals being applied.

All cables must be labeled and identified on corresponding termination drawings. A copy of the termination drawing will be adequately protected and left in its respective panel.

The Temperature Controls Contractor will make all required panel and field terminations.

Electrical work will be in accordance with NFPA 70 and ANSI C2. Electrical wiring, terminal blocks and other high voltage contacts will be fully enclosed and marked to prevent accidental injury.

All line voltage wiring and terminations (120V or greater) will be the responsibility of the Electrical Contractor. All low voltage wiring and terminations (less than 120V) will be the responsibility of the Temperature Controls Contractor. The term "wiring" is construed to include furnishing of wire, conduit, miscellaneous material and labor as required to install a total working system.

It is the responsibility of the Electrical Contractor to provide adequate connections and extensions to existing power sources to the various items of equipment requiring power under this contract. This Contractor may utilize spare circuits or space for spare circuit breaker where available in panelboards. Branch circuits serving equipment under this contract will be separate and used only for such equipment. All branch circuit conductors 120 volts or greater will be at least 14 gauge copper, type THW, 600 volt insulation, installed in minimum 3/4" conduit (EMT).

Transient Protection - All electronic equipment including processors, relays, monitoring devices, temperature sensors, VFD's and other non-computerized solid state equipment will be adequately protected against power line transients or RFI interference. Equipment that fails to operate properly due to transient or other electrical interference, in the opinion of the Engineer, will be required to be retrofitted with the appropriate protection device(s).

All control wiring will be installed in conduit as per Division 16, plenum rated cable is permitted only in accessible lay-in ceilings on this project.

In keeping with 1987 NEC Articles 300-8, 300-11, 725-38 and 760-28, no electrical wiring and polyethylene tubing may occupy the same conduit. Separate carriers are required for electric wiring and poly tubing.

VARIABLE FREQUENCY DRIVE:

Shall be for use with a standard NEMA B induction motor. All units are to be started up at the job site by a factory trained authorized representative and a one year parts and labor warranty.

Manufacturers:

- A. Yaskawa.
- B. Danfoss.

Drive must include the following:

- A. Maximum 5 percent total harmonic distortion of both voltage and amperage per IEEE 519. Input displacement power factor of 0.95 or higher at all operating speeds and loads.

The VFD shall be a microprocessor based digital Pulse Width Modulated (PWM) design. Current source designs and SCR-type units are not acceptable.

The PWM VFD shall provide the following design features as standard.

- A. Microprocessor Logic: The VFD shall be microprocessor based and utilize digital input for all parameter adjustments. Use of potentiometers for parameter adjustment is not acceptable.
- B. Auto Restart: The VFD shall automatically attempt to restart after a malfunction or an interruption of power. The number of attempted restarts shall be customer selectable (0 to 5). If the drive reaches the limit of restarts without successfully restating and running for a customer selectable length of time (60 to 600 seconds), the restart circuit shall lockout and shall provide contact annunciation. Delay between attempts to restart shall be customer selectable from 3 to 300 seconds.
- C. Current Limit: a current limit circuit shall be provided to limit motor current to a preset adjustable maximum level by reducing the drive operation speed or acceleration rate when the limit is reached. Range of adjustment shall be from 50 to 100 percent.
- D. Digital Output Displays and Input Parameter Programming: The VFD shall include a digital display and digital input programming capability on the main logic board. The display shall be programmable for indication of output speed in rpm, frequency, and percent of base speed, motor amps, output motor volts, and output load, the display shall also function as a first fault indicator.
- E. Firestat/Freezestat: The VFD shall provide terminals for connecting normally closed remote safety devices. This emergency shutdown shall operate in any mode of operation.
- F. Critical Frequency Avoidance: The VFD shall provide a minimum of two (2) selectable frequency jump points, in 1.5 Hz increments.
- G. Input Signal Follower: The input signal follower circuit shall have selectable differential inputs and accept an electrical speed command from an external source rated a t4-20 mA or voltage signals of 0-10 VDC. The input follower circuit shall be capable of operating directly or inversely proportional to the listed speed commands.
- H. Motor Overload Protection: Electronic motor protection shall be provided which is capable of predicting motor winding temperature based on inputting motor full load amps. The protection shall provide an orderly shutdown should the motor's thermal capabilities be exceeded. This protection also eliminates the requirement for motor overload relays on single motor applications when a bypass is not used.
- I. Open Collector Outputs: The VFD shall include one (1) open collector outputs to indicate drive run, drive fault, and drive ready. (2) Form C relays (open controller outputs require separate 24V. power supply).
- J. Output Signals: The VFD shall include analog output signals for output load, output speed, and motor load. The signals shall be 0 to 10 Vdc @ 1 mA, 2-10 VDC, 4-20 mA or 12 VDC pulse.
- K. Stop Mode Functions: The VFD stopping mode functions shall be selectable for coast-to-rest or stopping at programmed decel rate.
- L. V/Hz Profiles: The VFD shall provide up to four (4) selectable V/Hz profiles.
- M. Loss of Control Signal: The VFD shall revert to the last speed on loss of input control signal. Owner shall be able to field select a preset speed for the VFD to run when control signal is lost, if preferred. In either case, an open collector output shall be selected to indicate loss of control signal for remote indication purposes.
- N. The PWM VFD design shall provide the following:
 - 1. Input Section: Full wave rectification shall be achieved with input diodes in a conventional bridge configuration and shall be used to supply voltage to the DC bus.
 - 2. DC Bus: The DC shall be filtered by a series choke between the input section and one or more capacitors to provide ripple free dc current. An additional series choke shall be located between the bus capacitors and the inverter to provide enhanced output

- short circuit and ground fault protection. VFDs which use only bus capacitors require that input isolation transformers or input line filters be supplied.
3. Output Section: The inverter shall use GTB transistors to provide three phase output power to the motor.
- O. The VFD supplier shall provide the same design / technology to cover the HP range for all VFD's. VFD supplier to provide the following documentation:
1. Documentation showing that the VFD is the same basic design.
 2. One Instruction Manual to cover the full HP range for all VFDs.
 3. Explanation of commonality of spare parts for all VFDs.
- P. Output ratings. The VFD shall operate within the following ratings:
1. Frequency range, 1-66 Hz.
 2. Frequency resolution, .1 percent of base speed with analog input .025 percent with digital input.
 3. Frequency accuracy within .05 percent of set point.
 4. Overload rating, 110 percent for one minute.
- Q. Motor performance.
1. The VFD shall provide 3 percent speed regulation.
 2. Input power. The VFD shall operate within the following parameters:
208V (+10%/-15%), or 240V (+10%/-15%), or 480V (+10%/-15%)
- R. Set-up adjustments. Standard setup adjustments shall include:
1. Minimum speed, 0 to 100 percent.
 2. Maximum speed, 0 to 100 percent.
 3. Linear accel, .5 to 600 seconds.
 4. Linear decel, .5 to 600 seconds.
 5. Maximum output voltage, adjustable.
 6. V/Hz, adjustable with selectable profiles.
 7. Current limit, 50 to 110 percent.
- S. Environmental ratings. The VFD shall operate within the following parameters without the requirements for derating:
1. Operating temperature, 0 degree C to 40 degrees C.
 2. Altitude to 100m (3,300 ft.).
 3. Humidity, 95 percent non-condensing.
- T. Enclosure. The drive shall be furnished in NEMA 1 enclosure unless protection requires NEMA 12 for dusty or oily environments. Finned heatsinks and/or cooling fans shall be provided as necessary for proper heat dissipation. Inlet filters are required on all cooling fans, unless they are outside the drive enclosure and no circulated air passes circuit boards, transistors, or other electrical components. For indoor - NEMA 1.
- U. Codes and standards. The VFD shall meet the following standards:
1. CSA.
 2. ETL (UL 508).
 3. NEMA.
 4. NEC.
- V. Protective Features: The VFD shall be designed to meet the following specifications and operate within the following parameters:
1. AC Input Fuses: The VFDs power circuit shall be fused and isolated internally with respect to ground. Fuses shall provide a minimum of 100,000 A interrupting capacity.
 2. Logic Common: The power unit's logic common shall be at ground potential.

3. Phase Loss Protection: Phase loss protection shall be provided to prevent single phasing.
 4. Phase Loss Ride-Through: The VFD shall be capable of continued operation during an intermittent loss of power for 0.1 seconds (6 cycles). Opening the VFDs input and/or output line switches while operating shall not result in damage to the power circuit components.
 5. Short Circuit and Ground Fault Protection: The VFD shall have an instantaneous electronic trip circuit to protect the VFD from output line-to-line and line-to-ground short circuits. The VFD must be capable of withstanding short circuits at 480V plus 10 percent (528V). The VFD supplier must demonstrate ground fault and short circuit protection at time of start up or plant witness test. The VFD shall be capable of providing 110 percent motor current intermittently. The VFD shall include an instantaneous overcurrent trip and shall not restart after electronic overcurrent trip until reset through the run/stop circuit, or unless the auto restart function has been enabled.
 6. Transient and Surge Voltage Protection: Transient and surge voltage protection shall be provided through the use of Metal Oxide Varistors (MOVs). The VFD shall withstand a 6,000volt, 80 joule surge voltage when tested in accordance with ANSI/IEEE C62.41-1980 with the test circuit adjusted for a 2,100 amp peak 8x20 microseconds short circuit discharge current pulse.
 7. Rotating Motor Start: The VFD shall be able to start into a motor rotating in either direction and at any speed, and accelerate to set speed without any time delay, tripping or component loss.
 8. Load Side Disconnects: A disconnect switch may be used on the load side of the VFD near the motor for ease of service and safety. Operating the switch with the VFD running shall not cause any component failure. In dual motor applications, VFD shall be able to operate either motor with the other motor disconnected without requiring jumpers, parameter modifications, or other adjustments. As part of start-up, VFD supplier shall certify all load side disconnects can be opened or closed with drive running at full speed without damage to the drive.
- W. Reliability: A complete description of supplier's Quality Assurance and Testing program shall be provided.
1. Component Testing. All power semiconductors and integrated circuits shall be 100 percent tested.
 2. Computerized ATE Testing: Computerized Automated Testing Equipment (ATE) testing shall be used to evaluate functional performance of printed circuit boards. Printed circuit boards shall receive a thermal stress test where temperatures are cycled between 0 degrees C and 65 degrees C and receive electrical power-on and power-off cycle tests.
 3. Burn In: All VFDs shall be tested/run in the equivalent of a NEMA 1 enclosure and burned in at rated ambient (40°C) with a fully loaded motor.
- X. Maintainability:
1. All control circuit voltages (12VAC, 24VDC, 160VDC and 120VAC) shall be physically and electrically isolated from power circuit voltages (200 to 600VAC, 600VDC) to ensure safety to maintenance personnel.
 2. The VFD shall be furnished with an alphanumeric diagnostic display with fault indications to include the following: bus overvoltage, bus undervoltage, overcurrent, overtemperature, ground fault, and timed overload.
 3. All printed circuit boards shall utilize quick disconnect plugs and/or pull apart terminal blocks to facilitate maintenance by providing quick change-out without disconnecting terminal strip connections thereby reducing wiring errors.

4. VFD shall be capable of starting and operating without a motor connected for ease of service.
5. All setup and operating parameters shall be stored in nonvolatile memory. The static memory module shall to be removed and installed in replacement logic boards with all setup and operating parameters intact requiring no adjustment of replacement boards.

Y. Additional Features:

1. Operator Panel: A door-mounted Softtouch Operator Panel shall be included with the following features:
 - a. Shall digitally display motor speed, load, amps, and output volts (and controller set point and system pressure when set point controller is included).
 - b. Shall have keypad display for indicating drive run, drive ready, drive fault, plus operator function / status indication such as auto speed reference, and auto restart.
 - c. Shall provide selection for Hand/Off/Auto control. In Hand mode, the VFD shall be started and stopped from the operators panel. In the Auto mode, the VFD shall be started and stopped by remote contact closure. In the Off mode, the VFD shall be locked out.
 - d. Shall provide selection for Manual/Auto Speed Reference. In the Manual Reference mode, the VFD speed reference shall be set from the operators panel. In the Auto Reference mode, the VFD speed reference shall be set by the external source instrument signal. Selecting between Manual and Auto speed reference shall have no bearing on the Hand/Off/Auto start/stop selector, or vice versa.
 - e. Shall name all parameters in English, not codes or numbers.
 - f. Keypad shall include electronic lock-out feature to prevent unauthorized personnel from parameter access.
 - g. Shall store up to ten (10) drive faults in a history batch file in the order they occur to simply trouble-shooting. This file will automatically be updated should new faults occur.
2. Automatic Bypass Control Circuitry: Bypass control circuitry shall be mounted integrally to the VFD enclosure. The bypass shall utilize an input switch to feed the VFD and isolate the VFD for trouble shooting. An output contractor which is electrically and mechanically interlocked with the bypass starter shall be utilized on the VFD to provide a positive disconnect between the VFD and the motor. Separate Hand/Off/Auto and Inverter/Bypass switches shall be included to allow manual or automatic transfer to across-the-line operation. If the VFD trips on a fault, power will automatically transfer across the line to run the motor at full speed. If the VFD auto restart function has been enabled, the drive will first attempt to restart itself after a fault. If it is unable to do so within the number of times programmed, power will then automatically transfer across the line. Auxiliary contacts, and overload relay with adjustable heater settings shall also be included. Any protective shutdown circuits shall function in all modes (hand, auto, or bypass).
3. A120V. control transformer fused on both the primary and the secondary. Disconnect Switch: The operating mechanism shall be designed so that the door can be padlocked in the "OFF" position. The switch shall have an interrupting capacity of 65,000 symmetrical amperes.
4. Communications Port: A communications port for RS 232C or RS 422 communications with selectable baud rates for 300, 1200, or 2400 baud shall be provided.
5. Provide factory start up, adjustment, and initialization.
6. NEMA 4X enclosure for exterior installations.
7. Elapsed time meter to indicate how long the drive has been running.

8. On-site owner training of at least 4 hours shall be provided, and must include a complete description on Theory of Operation, Operating Procedures, Functional and Operating Characteristics of Specific Logic Boards, Troubleshooting, Repair, and Preventative Maintenance. A simulated failure shall be diagnosed. All costs for instructor's time, travel, meals, lodging, etc. shall be included.

WORKSTATION OPERATOR INTERFACE:

Basic Interface Description: Operator workstation interface software shall minimize operator training through the use of English language prompting, English language point identification and industry standard PC application software. The software shall provide, as a minimum, the following functionality:

- A. Graphical viewing and control of environment
- B. Scheduling and override of building operations
- C. Collection and analysis of historical data
- D. Definition and construction of dynamic color graphic displays
- E. Editing, programming, storage and downloading of controller databases

Provide a graphical user interface which shall minimize the use of a typewriter style keyboard through the use of a mouse or similar pointing device and "point and click" approach to menu selection. Users shall be able to start and stop equipment or change setpoints from graphical displays through the use of a mouse or similar pointing device.

Provide functionality such that all operations can also be performed using the keyboard as a backup interface device.

Provide additional capability that allows at least 10 special function keys to perform often-used operations.

The software shall provide a multi-tasking type environment that allows the user to run several applications simultaneously. The mouse shall be used to quickly select and switch between multiple applications. This shall be accomplished through the use of Microsoft Windows^a or similar industry standard software that supports concurrent viewing and controlling of systems operations.

Provide functionality such that any of the following may be performed simultaneously, and in any combination, via user-sized windows:

- A. Dynamic color graphics and graphic control
- B. Alarm management coordinated with alarm section.
- C. Time-of-day scheduling
- D. Trend data definition and presentation
- E. Graphic definition
- F. Graphic construction

Scheduling:

Provide a graphical spreadsheet-type format for simplification of time-of-day scheduling and overrides of building operations. Provide the following spreadsheet graphic types as a minimum:

- A. Weekly schedules
- B. Zone schedules
- C. Monthly calendars

Weekly schedules shall be provided for each building zone or piece of equipment with a specific occupancy schedule. Each schedule shall include columns for each day of the week as well as holiday and special day columns for alternate scheduling on user-defined days. Equipment scheduling shall be accomplished by simply inserting occupancy and vacancy times into appropriate information blocks on the graphic. In addition, temporary overrides and associated times may be inserted into blocks for modified operating schedules. After overrides have been executed, the original schedule will automatically be restored.

Zone schedules shall be provided for each building zone as previously described. Each schedule shall include all commandable points residing within the zone. Each point may have a unique schedule of operation relative to the zone's occupancy schedule, allowing for sequential starting and control of equipment within the zone. Scheduling and rescheduling of points may be accomplished easily via the zone schedule graphic.

Monthly calendars for a 24-month period shall be provided which allow for simplified scheduling of holidays and special days in advance. Holidays and special days shall be user-selected with the pointing device and shall automatically reschedule equipment operation as previously defined on the weekly schedules.

Dynamic Color Graphic Displays:

Color graphic floor plan displays and system schematics for each piece of mechanical equipment, including air handling units, fpvav's, vav's, unit ventilators, chilled water systems and hot water boiler systems, shall be provided by the BAS contractor as indicated in the point I/O summary of this specification to optimize system performance analysis and speed alarm recognition.

The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection or text-based commands.

Dynamic temperature values, humidity values, flow values and status indication shall be shown in their actual respective locations and shall automatically update to represent current conditions without operator intervention.

The windowing environment of the PC operator workstation shall allow the user to simultaneously view several graphics at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.

Graphic generation software shall be provided to allow the user to add, modify or delete system graphic displays.

The BAS contractor shall provide libraries of pre-engineered screens and symbols depicting standard air handling unit components (e.g., fans, cooling coils, filters, dampers, etc.), complete mechanical systems (e.g., constant volume-terminal reheat, VAV, etc.) and electrical symbols.

The graphic development package shall use a mouse or similar pointing device in conjunction with a drawing program to allow the user to perform the following:

- A. Define symbols
- B. Position and size symbols
- C. Define background screens
- D. Define connecting lines and curves
- E. Locate, orient and size descriptive text
- F. Define and display colors for all elements

- G. Establish correlation between symbols or text and associated system points or other displays

Graphical displays can be created to represent any logical grouping of system points or calculated data based upon building function, mechanical system, building layout or any other logical grouping of points which aids the operator in the analysis of the facility.

To accomplish this, the user shall be able to build graphic displays that include point data from multiple DDC Controllers including Application Specific Controllers used for DDC equipment or VAV terminal unit control.

PART 3 EXECUTION

EXAMINATION:

Verify that conditioned power supply is available to control units and operator workstation.

Verify that duct-, pipe-, and equipment-mounted devices and wiring and pneumatic piping are installed before proceeding with installation.

INSTALLATION:

Install equipment level and plumb.

Install software in control units and operator workstation. Implement all features of programs to specified requirements and as appropriate to sequence of operation.

Connect and configure equipment and software to achieve sequence of operation specified.

Verify location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation. **Locate all 48 inches (1100 mm) above the floor.**

- A. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

Install guards on thermostats in the following locations:

- A. Entrances.
- B. Public areas.
- C. Where indicated.

The Mechanical Contractor is to install automatic dampers according to Division 23 Section "Duct Accessories."

Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

Install labels and nameplates to identify control components according to Division 23 Section "Basic Mechanical Materials and Methods."

The Mechanical Contractor is to install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."

The Mechanical Contractor is to install refrigerant instrument wells, valves, and other accessories

according to Division 23 Section "Refrigerant Piping."

The Mechanical Contractor is to install duct volume-control dampers according to Division 23 Sections specifying air ducts.

The Electrical Contractor is to install all line voltage wiring and terminations (120V and above), concealed or exposed in accordance with Division 26, under strict supervision of the Building Controls Contractor.

The Electrical Contractor is to provide and install conduit and box rough-in for space sensors.

Install electronic and fiber-optic cables according to Division 26 Section "Control/Signal Transmission Media."

ELECTRICAL WIRING AND CONNECTION INSTALLATION:

Install raceways, boxes, and cabinets according to Division 26 Section "Raceways and Boxes."

Install building wire and cable according to Division 26 Section "Conductors and Cables."

Install signal and communication cable according to Division 26 Section "Control/Signal Transmission Media."

- A. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
- B. Install exposed cable in raceway or conduit.
- C. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
- D. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
- E. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.

Connect manual-reset limit controls independent of manual-control switch positions.

Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

CONNECTIONS:

Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

- A. Install piping adjacent to machine to allow service and maintenance.

Ground equipment.

- 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.

DDC TEMPERATURE CONTROL CONTRACTOR/TESTING AND BALANCING CONTRACTOR COORDINATION:

The temperature Control Contractor shall make control system modifications as necessary to facilitate balancing of the system by either of the two methods listed:

Have a technical representative continuously present at each step of the continuation of the balancing or furnish the Testing and Balancing Contractor with the latest DDC software and any required interface device (IE portable computer) for the duration of the balancing process. This option includes instructing the Balancer in the use of the interface device and software until the Balancer is proficient in the use of the software. portable computer, interface device, and software shall be returned to the Temperature Control Contractor when balance report has been approved. There shall be no charge to the Owner or the Testing and Balancing Contractor for the use of the software, interface device or portable computer.

FIELD QUALITY CONTROL:

Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

- A. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment, and retest.
- C. Calibration test electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.

Engage a factory-authorized service representative to perform startup service.

Replace damaged or malfunctioning controls and equipment.

- A. Start, test, and adjust control systems.
- B. Demonstrate compliance with requirements, including calibration and testing, and control sequences.
- C. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

Verify DDC as follows:

- A. Verify software including automatic restart, control sequences, scheduling, reset controls, and occupied/unoccupied cycles.
- B. Verify operation of operator workstation.
- C. Verify local control units including self-diagnostics.

WARRANTY:

The special warranty specified in the article shall not deprive the Owner of other rights the Owner may have under other provision 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 document.

Special Warranty: Submit a written warranty signed by the Temperature Controls Contractor agreeing to furnish parts and labor for the entire system for a period of 3 years from the date of Substantial Completion.

END OF SECTION

23 21 13 HYDRONIC PIPING

PART 1 GENERAL**RELATED DOCUMENTS**

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section.

SUMMARY

This Section includes piping, special-duty valves, and hydronic specialties for hot-water heating, chilled-water cooling and condenser water systems; makeup water for these systems; blowdown drain lines; and condensate drain piping.

Related Section include the following:

- A. Division 7 Section "Through-Penetration Firestop Systems" for materials and methods for sealing pipe penetrations through fire and smoke barriers.
- B. Division 7 Section "Joint Sealants" for materials and methods for sealing pipe penetrations through exterior walls.
- C. Division 23 Section "Basic Mechanical Materials and Methods" for general piping materials and installation requirements.
- D. Division 23 Section "Hangers and Supports" for pipe supports, product descriptions and installation requirements. Hanger and support spacing is specified in this Section.
- E. Division 23 Section "Valves" for general-duty gate, globe, ball, butterfly and check valves.
- F. Division 23 Section "Meters and Gages" for thermometers, flow meters and pressure gages.
- G. Division 23 Section "Mechanical Identification" for labeling and identifying hydronic piping.
- H. Division 23 Section "Hydronic Pumps" for pumps, motors and accessories for hydronic piping.
- I. Division 23 Section "HVAC Instrumentation and Controls" for temperature-control valves and sensors.

SUBMITTALS:

Product Data: For each type of special-duty valve indicated. Include flow and pressure drop curves based on manufacturer's testing for diverting fittings, calibrated balancing valves, and automatic flow-control valves.

Shop Drawings: Detail fabrication of pipe anchors, hangers on special pipe support assemblies, alignment guides, expansion joints and loops, and their attachment to the building structure. Detail location of anchors, alignment guides and expansion joints and loops.

Grooved Joint Couplings and Fittings: Grooved joint couplings and fittings shall be shown on drawings and product submittals, and shall be specifically identified with the applicable style or series designation.

Welding Certificate: Copies of certificates for welding procedures and personnel.

Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:

- A. Test procedures used.
- B. Test results that comply with requirements.
- C. Failed test results and corrective action taken to achieve requirements.

Maintenance Data: For hydronic specialties and special-duty valves to include in maintenance manuals specified in Division 1.

QUALITY ASSURANCE

Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

Grooved Joint Couplings and Fittings: All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

- A. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

COORDINATION

Coordinate layout and installation of hydronic piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression system components, and partition assemblies.

Coordinate pipe sleeve installation for foundation wall penetrations.

Coordinate piping installation with roof curbs, equipment supports and roof penetrations.

Coordinate pipe pressure classes with products specified in related Sections.

Coordinate size and location of concrete bases. Cast anchor bolt inserts into base.

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Grooved Mechanical-Joint Fittings and Couplings:
 - 1. Central Sprinkler Company; Central Grooved Piping Products.
 - 2. Grinnell Corporation.
 - 3. Victaulic Company of America.
- B. Pressure-Reducing Valves:
 - 1. Amtrol, Inc.
 - 2. Armstrong Pumps, Inc.
 - 3. Conbraco Industries, Inc.
 - 4. ITT Bell & Gossett; ITT Fluid Technology Corp.
 - 5. Watts Industries, Inc.; Watts Regulators.
- C. Safety Valves:
 - 1. Amtrol, Inc.
 - 2. Armstrong Pumps, Inc.

3. Conbraco Industries, Inc.
4. ITT McDonnell & Miller Div.; ITT Fluid Technology Corp.
5. Kunkle Valve Division.

D. Expansion Tanks

1. Amtrol, Inc.
2. Armstrong Pumps, Inc.
3. ITT Bell & Gossett.
4. Taco, Inc.
5. John Wood Co.

E. Coalescing Air and Dirt Separators:

1. Spirotherm.

PIPING MATERIALS:

General: Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

COPPER TUBE AND FITTINGS:

Drawn-Tempered Copper Tubing: ASTM B 88, Type L.

Annealed-Temper Copper Tubing: ASTM B 88, Type K.

DWV Copper Tubing: ASTM B 306, Type DWV.

Wrought-Copper Fittings and Unions: ASME B16.22.

Solder Filler Metals: ASTM B 32, 95-5 tin antimony.

Brazing Filler Metals: AWS A5.8, Classification Bag-1 (silver).

STEEL PIPE AND FITTINGS:

Steel Pipe, NPS 2" and smaller: ASTM A 53, Type S (seamless), Grade A, Schedule 40, black steel, plain or grooved ends.

Steel Pipe, NPS 2-1/2" through NPS 12: ASTM A 53, Type E (electric-resistance welded, ERW), Grade A, Schedule 40, black steel, plain or grooved ends.

Steel Pipe, NPS 14" through 20": ASTM A 53, Type E or Type S, Grade A, Schedule 40, black steel, plain or grooved ends.

Steel Pipe Nipples: ASTM A 733, made of ASTM A 53, Schedule 40, black steel; seamless for NPS 2" and smaller and ERW for NPS 2-1/2" and larger.

Cast-Iron Threaded Fittings: ASME B16.4, Classes 125 and 250.

Malleable-Iron Threaded Fittings: ASME B16.3, Classes 125 and 250.

Malleable-Iron Unions: ASME B16.39, Classes 150, 250 and 300.

Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125 and 250; raised ground face and bolt holes spot faced.

Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts and gaskets for the following material group, end connections and facings:

- A. Material Group: 1.1.
- B. End Connections: Butt welding.
- C. Facings: Raised face.

Grooved Mechanical-Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 53, Type E or S, Grade B factory-fabricated steel; or ASTM A 234, Grade WPB wrought steel fittings with grooves or shoulders designed to accept grooved end couplings.

Grooved Mechanical-Joint Couplings: Two ductile iron housings and synthetic rubber gasket of central cavity pressure-responsive design; with nuts and bolts to secure grooved end fittings and valves.

- A. Rigid Type: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9.
 - a. 2" through 8": Installation-Ready, for direct stab installation without field disassembly, with grade EHP gasket rated to +250 deg F. Victaulic Style 107H.
 - b. Victaulic Zero-Flex Style 07.
- B. Flexible Type: For use in locations where vibration attenuation and stress relief are required. Three flexible couplings may be used in lieu of a flexible connector. Victaulic Installation-Ready Style 177 or Style 77.
- C. 14" through 24": Victaulic AGS series with lead-in chamfer on housing key and wide width FlushSeal® gasket.
 - a. Rigid Type: Housing key shall fill the wedge shaped AGS groove and provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9. Victaulic Style W07.
 - b. Flexible Type: Housing key shall fit into the wedge shaped AGS groove and allow for linear and angular pipe movement. Victaulic Style W77.
- D. Flange Adapter: Flat face, ductile iron housings with elastomer pressure responsive gasket, for direct connection to ANSI Class 150 flanged components. Victaulic Style 741 / W741.

Flexible Connectors (up to NPS 4"): Stainless steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150 psig minimum working pressure and 250 deg. F maximum operating temperature. Connectors shall have flanged or threaded-end connections to match equipment connected and shall be capable of 3/4" misalignment.

Flexible Connector, Grooved Joint Couplings (NPS 2" and larger): Three Victaulic flexible couplings may be used in lieu of a flexible connector for vibration attenuation and stress relief. The couplings shall be placed in close proximity to the source of the vibration.

Packed, Slip, Expansion Joints: 150-psig minimum working pressure, steel pipe fitting consisting of telescoping body and slip-pipe sections, packing ring, packing, limit rods, flanged ends, and chrome-plated finish on slip-pipe telescoping section.

Grooved End Expansion Joints:

- A. Packless, Gasketed, Slip, Expansion Joints: 350-psig maximum working pressure, steel pipe fitting consisting of telescoping body and slip-pipe sections, PTFE modified polyphenylene sulfide coated slide section, with grooved ends. Suitable for axial end movement to 3". Basis of Design: Victaulic Style 150.
- B. Expansion joint consisting of a series of grooved end pipe nipples joined in tandem with Victaulic flexible couplings. Total joint movement dependent on the number of couplings and nipples used. Basis of Design: Victaulic Series 155.

Welding Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

Gasket Material: Thickness, material and type suitable for fluid to be handled; and design temperatures and pressures.

Grooved Joint Lubricants: Lubricate gaskets in accordance with the manufacturer's recommendations with lubricant supplied by the coupling manufacturer that is suitable for the gasket elastomer and system media. Basis of Design: Victaulic 'Vic-Lube'.

PLASTIC PIPE AND FITTINGS:

CPVC Plastic Pipe: ASTM F 441, Schedules 80, plain end.

CPVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM F 438 for Schedule 40 pipe, ASTM F 439 for Schedule 80 pipe.

CPVC Solvent Cement: ASTM F 493.

VALVES:

Globe, check, ball and butterfly valves are specified in Division 23 Section "Valves."

Refer to Part 3 "Valve Applications" Article for applications of each valve.

Pressure-Reducing Valves: Diaphragm-operated, bronze or brass body with low inlet pressure check valve, inlet strainer removable without system shutdown and noncorrosive valve seat and stem. Select valve size, capacity and operating pressure to suit system. Valve shall be factory set at operating pressure and have capability for field adjustment.

Safety Valves: Diaphragm-operated, bronze or brass body with brass and rubber, wetted, internal working parts; shall suit system pressure fluctuations and equipped with a readout kit including flow meter, probes, hoses, flow charts and carrying case. Each valve shall have an identification tag attached by chain, and be factory marked with the zone identification, valve number, and flow rate. Valve shall be line size and one of the following designs:

- A. Gray-iron or brass body, designed for 175 psig at 200 deg. F with stainless-steel piston and spring.
- B. Brass or ferrous-metal body, designed for 300 psig at 250 deg. F with corrosion-resistant, tamperproof, self-cleaning, piston-spring assembly easily removable for inspection or replacement.
- C. Combination assemblies, including bronze ball valve and brass alloy control valve, with stainless-steel piston and spring, fitted with pressure and temperature test valves and designed for 300 psig at 250 deg. F.

HYDRONIC SPECIALTIES:

Manual Air Vents: Bronze body and nonferrous internal parts, 150 psig working pressure, 225 deg. F operating temperature, manually operated with screwdriver or thumbscrew with NPS 1/8 discharge connection and NPS 1/2 inlet connection.

Automatic Air Vent: Designed to vent automatically with float principle, bronze body and nonferrous internal parts, 150 psig operating pressure, 240 deg. F operating temperature, with NPS 1/4 discharge connection and NPS 1/2 inlet connection.

Y-Pattern Strainers: 300 psig working pressure, ductile-iron body (ASTM A536 Grade 65-45-12) with grooved ends, or cast-iron body (ASTM A 126, Class B), flanged ends for NPS 2-1/2" and larger, threaded connections for NPS 2" and smaller, bolted cover, perforated stainless-steel basket and bottom drain connection.

Flexible Connectors (up to NPS 4"): Stainless steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150 psig minimum working pressure and 250 deg. F maximum operating temperature. Connectors shall have flanged or threaded-end connections to match equipment connected and shall be capable of 3/4" misalignment.

Flexible Connector, Grooved Joint Couplings (NPS 2" and larger): Three Victaulic flexible couplings may be used in lieu of a flexible connector for vibration attenuation and stress relief. The couplings shall be placed in close proximity to the source of the vibration.

Packed, Slip, Expansion Joints: 150-psig minimum working pressure, steel pipe fitting consisting of telescoping body and slip-pipe sections, packing ring, packing, limit rods, flanged ends, and chrome-plated finish on slip-pipe telescoping section.

Grooved End Expansion Joints:

- A. Packless, Gasketed, Slip, Expansion Joints: 350-psig maximum working pressure, steel pipe fitting consisting of telescoping body and slip-pipe sections, PTFE modified polyphenylene sulfide coated slide section, with grooved ends. Suitable for axial end movement to 3".
- B. Expansion joint consisting of a series of grooved end pipe nipples joined in tandem with Victaulic flexible couplings. Total joint movement dependent on the number of couplings and nipples used.

PART 3 EXECUTION

PIPING APPLICATIONS:

Hot and Chilled Water, NPS 2" and Smaller: Type L drawn-temper copper tubing with soldered joints or Schedule 40 steel pipe with threaded joints.

Hot Water, NPS 2-1/2" and Larger: Schedule 40 steel pipe with welded or grooved joints.

Chilled Water, NPS 2-1/2" and Larger: Schedule 40 steel pipe with welded or grooved joints, or Schedule 80 CPVC.

Condensate Drain Lines: Type L drawn-tempered copper tubing with soldered joints.

VALVE APPLICATIONS:

General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:

- A. Shutoff Duty: Gate, ball and butterfly.
- B. Throttling Duty: Globe, ball and butterfly.

Install shutoff duty valves at each branch connection to supply mains and at supply and return connections to each piece of equipment.

Install check valves at each pump discharge and elsewhere as required to control flow direction.

Install safety valves at each pump discharge and elsewhere as require by the ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to floor drain. Comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, for installation requirements.

PIPING INSTALLATIONS:

Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation requirements.

Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

Install drains, consisting of a tee fitting, NPS 3/4" ball valve and short NPS 3/4" threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

Reduce pipe sizes using eccentric reducer fitting installed with level side up.

Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming off the top of the main pipe at a 45 degree angle. For up-feed risers, install the takeoff coming out the top of the main pipe.

Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, in-line pump and elsewhere as indicated. Install NPS 3/4" nipple and ball valve in blowdown connection of strainers NPS 2" and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2".

Anchor piping for proper direction of expansion and contraction.

For water systems, use adequate numbers of Victaulic flexible couplings in header piping to accommodate thermal growth and contraction, and for the elimination of expansion loops. (In accordance with Victaulic instructions and as approved by the engineer.) Where expansion loops are required, use Victaulic flexible couplings on the loops.

HANGERS AND SUPPORTS:

Hanger, support and anchor devices are specified in Division 23 Section "Hangers and Supports." Comply with requirements below for maximum spacing of supports.

Install the following pipe attachments:

- A. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
- B. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
- C. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
- D. Spring hangers to support vertical runs.
- E. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

Install hangers for copper tubing, steel, and ductile iron with the following maximum spacing:

- A. 1-1/2" NPS (DN40) and Smaller: Maximum horizontal spacing, 60 inches (1500 mm); maximum vertical spacing, 10 feet (3 m).
- B. 2" through 2-1/2" NPS (DN50 to DN65): Maximum horizontal spacing, 72 inches (1800 mm); maximum vertical spacing, 10 feet (3 m).
- C. 3" NPS (DN80) and Larger: Maximum horizontal spacing, 10 feet (3 m); maximum vertical spacing, 10 feet (3 m).

Install hangers for CPVC plastic piping with the following maximum spacing:

- A. 8" NPS (DN200) and Smaller: Maximum horizontal spacing, 48 inches (1200 mm); maximum vertical spacing, 10 feet (3 m).

Minimum rod size to be according to manufacturer's written instructions for service conditions base on maximum hanger spacing.

Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

PIPE JOINT CONSTRUCTION:

Refer to Division 23 Section "Basic Materials and Methods" for joint construction requirements for soldered and brazed joints in copper tubing; threaded, welded and flanged joints in steel piping; and solvent-weld joints for CPVC piping.

Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)

Install Vic-Press 304™ in accordance with Victaulic recommendations. Pipe shall be certified for use with the Vic-Press 304™ system, square cut (+/-0.030"), properly deburred, and cleaned. Pipe ends shall be marked with a gauge supplied by Victaulic. Use a Victaulic 'PFT' series tool with the proper sized jaw for pressing.

HYDRONIC SPECIALTIES INSTALLATION:

Install manual air vents at high points in piping, at heat transfer coils and elsewhere as required for system air venting.

Install automatic air vents at air separator and elsewhere as indicated with drain to floor drain.

TERMINAL EQUIPMENT CONNECTIONS:

Size for supply and return piping connections shall be same as for equipment connections.

Install control valves in accessible locations close to connected equipment.

Install ports for pressure and temperature gages at coil inlet and outlet connections.

FIELD QUALITY CONTROL:

Prepare hydronic piping according to ASME B31.9 and as follows:

- A. Leave joints, including welds, uninsulated and exposed for examination during test.
- B. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
- C. Flush system with clean water. Clean strainers after each flush.
- D. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
- E. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

Perform the following tests on hydronic piping:

- A. Use ambient temperature water as a testing medium unless there is a risk of freezing. Another liquid that is safe for workers and compatible with piping may be used.
- B. While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.
- C. Check expansion tanks to determine that they are not air bound and that the system is full of water.
- D. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."
- E. After hydrostatic test pressure has been applied for at least 12 hours, examine piping, joints, and connections for leakage. Eliminate leaks and repeat test until there are no leaks.
- F. Prepare written report of testing.

ADJUSTING:

Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.

Perform these adjustments before operating the system:

- A. Open valves to fully open position.
- B. Check pump for proper direction of rotation.
- C. Set automatic fill valves for required system pressure.
- D. Check air vents at high points of system and determine if all are installed and operation freely (automatic type), or bleed air completely (manual type).
- E. Set temperature controls so all coils are calling for full flow.
- F. Check operation of automatic bypass valves.
- G. Check and set operating temperatures of boilers, chillers and cooling towers to design requirements.
- H. Lubricate motors and bearings.

CLEANING:

Flush hydronic piping systems with clean water. Remove and clean or replace strainer screens. After cleaning and flushing hydronic piping system, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.

END OF SECTION

23 21 23 HYDRONIC PUMPS

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes the following categories of hydronic pumps for hydronic systems:

- A. Vertical in-line pumps.

Related Sections include the following:

- A. Division 23 Section "Motors" for general motor requirements.
- B. Division 23 Section "Mechanical Vibration Controls and Seismic Restraints" for inertia pads isolation pads, spring supports and spring hangers.

SUBMITTALS:

Product Data: Include certified performance curves and rated capacities; shipping, installed, and operating weights; furnished specialties; final impeller dimensions; and accessories for each type of product indicated. Indicate pump's operating point on curves.

Shop Drawings: Show pump layout and connections. Include Setting Drawings with templates for installing foundation and anchor bolts and other anchorages.

Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

Maintenance Data: For pumps to include in maintenance manuals specified in Division 1.

QUALITY ASSURANCE:

UL Compliance: Fabricate and label pumps to comply with UL 778, "Motor-Operated Water Pumps," for construction requirements.

Product Options: Drawings indicate size, profiles, connections, and dimensional requirements of pumps and are based on the specific types and models indicated. Other manufacturers' pumps with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

Regulatory Requirements: Fabricate and test steam condensate pumps to comply with HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation," and HI 1.6, "Centrifugal Pump Tests."

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

DELIVERY, STORAGE, AND HANDLING:

Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

Store pumps in dry location.

Retain protective covers for flanges and protective coatings during storage.

Protect bearings and couplings against damage from sand, grit, and other foreign matter.

Comply with pump manufacturer's written rigging instructions.

COORDINATION:

Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

EXTRA MATERIALS:

Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Mechanical Seals: One mechanical seal for each pump.

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Vertical In-Line Pumps:
 - 1. Armstrong Pumps, Inc.
 - 2. Bell & Gossett ITT; Div. of ITT Fluid Technology Corp.
 - 3. Taco; Fabricated Products Div.

GENERAL PUMP REQUIREMENTS:

Pump Units: Factory assembled and tested.

Motors: Include built-in, thermal-overload protection and grease-lubricated ball bearings. Select each motor to be non-overloading over full range of pump performance curve.

Motors Indicated to Be Energy Efficient: Minimum efficiency as indicated according to IEEE 112, Test Method B. Include motors with higher efficiency than "average standard industry motors" according to IEEE 112, Test Method B, if efficiency is not indicated.

VERTICAL IN-LINE PUMPS:

Description: Vertical, in-line, centrifugal, flexible-coupled, single-stage, radially split case design. Include vertical-mounting, bronze-fitted design and mechanical seals rated for 125-psig (860-kPa) minimum working pressure and a continuous water temperature of 225 deg F (107 deg C).

Vertical In-Line pumps: 7.5 HP and less can be closed coupled. Pumps above 7.5 HP are to be flexible (split) coupled.

Casing: Cast iron, with threaded companion flanges for piping connections smaller than NPS 3 (DN80), drain plug at low point of volute, and threaded gage tappings at inlet and outlet connections.

Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, closed, overhung, single suction, and keyed to shaft.

Wear Rings: Replaceable, bronze casing ring.

Shaft: Ground and polished stainless-steel shaft with axially split spacer coupling.

Seals: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.

Motor: Directly mounted to pump casing and with lifting and supporting lugs in top of motor enclosure.

PUMP SPECIALTY FITTINGS:

Suction Diffuser: Angle or straight pattern, 175-psig (1200 kPa) pressure rating, cast-iron body and end cap, pump-inlet fitting; with bronze startup and bronze or stainless-steel permanent strainers; bronze or stainless-steel straightening vanes; drain plug and factory or field fabricated support.

Triple-Duty Valve: Angle or straight pattern, 175-psig (1200 kPa) pressure rating, cast-iron body, pump-discharge fitting; with drain plug and bronze-fitted shutoff, balancing, and check valve features.

PART 2 EXECUTION

EXAMINATION:

Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation.

Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

Proceed with installation only after unsatisfactory conditions have been corrected.

PUMP INSTALLATION:

Install pumps according to manufacturer's written instructions.

Install pumps to provide access for periodic maintenance, including removing motors, impellers, couplings, and accessories.

Support pumps and piping separately so piping is not supported by pumps.

ALIGNMENT:

Comply with pump and coupling manufacturers' written instruction.

Adjust pump and motor shafts for angular and offset alignment by methods specified in HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."

CONNECTIONS:

Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

Install piping adjacent to machine to allow service and maintenance.

Connect piping to pumps. Install valves that are the same size as piping to pumps, not pump suction or discharge connection sizes.

Install non-slam check valve and globe valve on discharge side of vertical turbine pumps.

Install non-slam check valve and globe valve on discharge side of vertical in-line pumps.

Install suction diffuser and shutoff valve on suction side of vertical in-line pumps.

Install triple-duty valve on discharge side of vertical in-line pumps.

Install flexible connectors on suction and discharge sides of pumps between pump casing and valves.

Install pressure gages on pump suction and discharge. Install at integral pressure-gage tapings where provided.

Electrical power and control wiring and connections are specified in Division 26 Sections.

Ground equipment: 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.

COMMISSIONING:

Verify that pumps are installed and connected according to the Contract Documents.

Verify that electrical wiring installation complies with manufacturer's written instructions and the Contract Documents.

Perform the following preventive maintenance operations and checks before starting:

- A. Lubricate bearings.
- B. Remove grease-lubricated bearing covers, flush bearings with kerosene, and clean thoroughly. Fill with new lubricant according to manufacturer's written instructions.
- C. Disconnect coupling and check motor for proper rotation that matches direction marked on pump casing.
- D. Verify that pumps are free to rotate by hand and that pumps for handling hot liquids are free to rotate with pumps hot and cold. Do not operate pumps if they are bound or drag, until cause of trouble is determined and corrected.
- E. Check suction piping connections for tightness to avoid drawing air into pumps.
- F. Clean strainers.
- G. Verify that pump controls are correct for required application.

Starting procedure for pumps with shutoff power not exceeding safe motor power is as follows:

- A. Prime pumps by opening suction valves and closing drains, and prepare pumps for operation.

- B. Open cooling water-supply valves in cooling water supply to bearings, where applicable.
- C. Open cooling water-supply valves if stuffing boxes are water cooled.
- D. Open sealing liquid-supply valves if pumps are so fitted.
- E. Open warm-up valves of pumps handling hot liquids if pumps are not normally kept at operating temperature.
- F. Open circulating line valves if pumps should not be operated against dead shutoff.
- G. Start motors.
- H. Open discharge valves slowly.
- I. Observe leakage from stuffing boxes and adjust sealing liquid valve for proper flow to ensure lubrication of packing. Let packing "run in" before reducing leakage through stuffing boxes; then tighten glands.
- J. Check general mechanical operation of pumps and motors.
- K. Close circulating line valves once there is sufficient flow through pumps to prevent overheating.

When pumps are to be started against closed check valves with discharge shutoff valves open, steps are the same, except open discharge valves before starting motors.

Refer to Division 23 Section "Testing, Adjusting, and Balancing" for detailed requirements for testing, adjusting, and balancing hydronic systems.

DEMONSTRATION:

Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps as specified below:

- A. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining pumps.
- B. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
- C. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION

23 23 00 REFRIGERANT PIPING

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY

This Section includes refrigerant piping used for air-conditioning applications, including pipes, tubing, fittings, and specialties; special-duty valves; and refrigerants.

Related Sections: The following Sections contain requirements that relate to this Section:

- A. Division 7 Section "Roof Accessories" for roof curbs, piping supports, and roof penetration boots.
- B. Division 7 Section "Joint Sealants" for materials and methods for sealing pipe penetrations through basement walls and fire/smoke barriers.
- C. Division 23 Section "Mechanical Identification" for labeling and identifying refrigerant piping.
- D. Division 23 Section "Mechanical Insulation" for pipe insulation.

SUBMITTALS

General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

Product Data for each valve type and refrigerant piping specialty specified.

Shop Drawings showing layout of refrigerant piping, specialties, and fittings, including pipe and tube sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and equipment.

- A. Refrigerant piping indicated is schematic only. Size and design the layout and installation of the piping, including oil traps, double risers, specialties, and pipe and tube sizes, to ensure proper operation and conformance with warranties of connected equipment.

Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience.

Maintenance data for refrigerant valves and piping specialties to include in the operation and maintenance manual specified in Division 1 Sections and Division 23 Section "Basic Mechanical Requirements."

QUALITY ASSURANCE

ASME Compliance: Qualify brazing and welding processes and operators according to ASME Boiler and Pressure Vessel Code, Section IX, "Welding and Brazing Qualifications."

Regulatory Requirements: Comply with provisions of the following codes:

- A. ASME B31.5, "Refrigeration Piping."

- B. ASHRAE 15, "Safety Code for Mechanical Refrigeration."
- C. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical"; or UL 429, "Electrically Operated Valves."
- D. Listing and Labeling: Provide products specified in this Section that are UL listed and labeled.

SEQUENCING AND SCHEDULING

Coordinate the installation of roof curbs, equipment supports, and roof penetrations. Roof specialties are specified in Division 7 Sections.

PART 2 PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Refrigerants:
 - 1. Allied Signal Inc.; Genetron Refrigerants.
 - 2. DuPont Company; Fluorochemicals Div.
 - 3. Elf Atochem North America, Inc.
 - 4. ICI Americas Inc.; Fluorochemicals Bus.
- B. Refrigerant Valves and Specialties:
 - 1. Danfoss Electronics, Inc.
 - 2. Eaton Corporation; Industrial Control Div.
 - 3. Emerson Electric Company; Alco Controls Div.
 - 4. Henry Valve Company.
 - 5. Parker-Hannifin Corp.; Refrigeration & Air Conditioning Division.
 - 6. Sporlan Valve Company.

PIPES AND TUBES

Hard Copper Tube: ASTM B 280, Type ACR, drawn temper.

Soft Copper Tube: ASTM B 280, Type ACR, annealed temper.

PIPE AND TUBE FITTINGS

Copper Fittings: ASME B16.22, wrought-copper streamlined pattern.

JOINING MATERIALS

Brazing Filler Metals: AWS A5.8, Classification BAg-1 (Silver).

VALVES

Diaphragm Packless Valves: 500 psig (3450 kPa) working pressure and 275 deg F (135 deg C) working temperature, globe or angle pattern, forged-brass or bronze body and bonnet, phosphor bronze and stainless-steel diaphragms, rising stem and handwheel, stainless-steel spring, nylon seat disc, with solder-end connections.

Packed-Angle Valves: 500 psig (3450 kPa) working pressure and 275 deg F (135 deg C) working temperature, forged-brass or bronze body, forged-brass seal caps with copper gasket, back seating, rising stem and seat, molded stem packing, with solder-end connections.

Check Valves--Smaller than 1" NPS (DN25): 500 psig (3450 kPa) operating pressure, 300 deg F (149 deg C) operating temperature; cast-brass body, with removable piston, PTFE seat, and stainless-steel spring; straight-through globe design. Valve shall be straight-through pattern, with solder-end connections.

Service Valves: 500 psig (3450 kPa) pressure rating, forged-brass body with copper stubs, brass caps, removable valve core, integral ball check valve, with solder-end connections.

Solenoid Valves: Conform to ARI 760; 250 deg F (121 deg C) temperature rating, 400 psig (2760 kPa) working pressure; forged brass, with PTFE valve seat, 2-way straight-through pattern, and solder-end connections; manual operator; with NEMA 250, Type 1 solenoid enclosure with ½ inch (13 mm) conduit adapter, and 24-V normally closed holding coil.

Pressure-Regulating Valves: Conform to ARI 770; direct acting, brass with pilot operator, stainless-steel diaphragm, standard coil, and solder-end connections.

Pressure Relief Valves: Straight or angle brass body and disc, neoprene seat, factory sealed and ASME labeled, for standard pressure setting.

Thermal Expansion Valves: Conform to ARI 750; thermostatic-adjustable, modulating type; size as required and factory set for superheat requirements; solder-end connections; with sensing bulb, distributor having side connection for hot-gas bypass line, and external equalizer line.

REFRIGERANT PIPING SPECIALTIES

Straight- or Angle-Type Strainers: 430 psig (2960 kPa) working pressure; forged-brass or steel body with stainless-steel wire or brass-reinforced Monel screen, and screwed cleanout plug, with solder-end connections.

Straight, Non-Cleanable-Type Strainers: 500 psig (3450 kPa) working pressure; steel shell with stainless-steel screen, with solder-end connections.

Moisture/Liquid Indicators: 500 psig (3450 kPa) operating pressure, 200 deg F (93 deg C) operating temperature; forged-brass body, with replaceable, polished, optical viewing window with color-coded moisture indicator, and solder-end connections.

Permanent Filter-Dryer: 350 psig (2140 kPa) maximum operating pressure, 225 deg F (107 deg C) maximum operating temperature; steel shell, and wrought-copper fittings for solder-end connections; molded-felt core surrounded by desiccant.

PART 3 EXECUTION

EXAMINATION

Examine roughing-in for compliance with requirements for installation tolerances and other conditions affecting performance of refrigerant piping. Do not proceed with installation until unsatisfactory conditions have been corrected.

APPLICATIONS

Aboveground, within Building: Type ACR drawn-copper tubing.

INSTALLATION

Install refrigerant piping according to ASHRAE 15.

Basic piping installation requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."

Install piping in short and direct arrangement, with minimum number of joints, elbows, and fittings.

Arrange piping to allow normal inspection and service of compressor and other equipment. Install valves and specialties in accessible locations to allow for service and inspection.

Install piping with adequate clearance between pipe and adjacent walls and hangers, or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

Insulate suction lines and liquid lines, but insulate them together if adjacent.

- A. Do not install insulation until system testing has been completed and all leaks have been eliminated.

Install branch lines to parallel compressors of equal length, and pipe identically and symmetrically.

Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.

Slope refrigerant piping as follows:

- A. Install horizontal hot-gas discharge piping with a uniform slope of 0.4 percent downward away from compressor.
- B. Install horizontal suction lines with a uniform slope of 0.4 percent downward to compressor.
- C. Install traps and double risers where indicated and where required to entrain oil in vertical runs.
- D. Liquid lines may be installed level.

Use fittings for changes in direction and branch connections.

Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

Reduce pipe sizes using eccentric reducer fittings installed with level side down.

Provide bypass around moisture-liquid indicators in lines larger than 2" NPS (DN50).

Install unions to allow removal of solenoid valves, pressure-regulating valves, expansion valves, and at connections to compressors and evaporators.

Install flexible connectors at the inlet and discharge connection, at right angles to axial movement of compressor, parallel to crankshaft.

Install refrigerant valves according to manufacturer's written instructions.

When brazing, remove solenoid-valve coils; remove sight glasses; and remove stems, seats, and packing of valves, and accessible internal parts of refrigerant specialties. Do not apply heat near bulb of expansion valve.

Electrical wiring for solenoid valves is specified in Division 16 Sections. Coordinate electrical requirements and connections.

Mount thermostatic expansion valves in any position, close to evaporator.

- A. Where refrigerant distributors are used, mount directly on expansion-valve outlet.
- B. Install valve so diaphragm case is warmer than bulb.

Verify proper location for bulb with valve manufacturer.

Secure bulb to clean, straight, horizontal section of suction line using 2 bulb straps. Do not mount bulb in a trap or at the bottom of the line.

Where external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

Install pressure relief valves as required by ASHRAE 15. Pipe pressure relief valves on receivers to outdoors.

Charge and purge systems, after testing, and dispose of refrigerant following ASHRAE 15 procedures.

Charge system as follows:

- A. Install filter-dryer core after leak test, but before evacuation.
- B. Evacuate refrigerant system with vacuum pump, until temperature of 35 deg F (1.7 deg C) is indicated on vacuum dehydration indicator.
- C. Maintain vacuum for a minimum of 5 hours.
- D. Break vacuum with refrigerant gas and charge to 2 psig (14 kPa).

HANGERS AND SUPPORTS

General: Hangers, supports, and anchors are specified in Division 23 Section "Hangers and Supports." Provide according to ASME B31.5 and MSS SP-69.

Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6 m) in length.

Roller hangers and spring hangers for individual horizontal runs 20 feet (6 m) or longer.

Pipe rollers for multiple horizontal runs, 20 feet (6 m) or longer supported by a trapeze.

Spring hangers to support vertical runs.

Tube sizes are nominal or standard tube sizes as expressed in ASTM B 88 (ASTM B 88M).

Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

Install hangers for copper tubing, steel, and ductile iron with the following maximum spacing:

- A. 1-1/2" NPS (DN40) and Smaller: Maximum horizontal spacing, 60 inches (1500 mm); maximum vertical spacing, 10 feet (3 m).
- B. 2" through 2-1/2" NPS (DN50 to DN65): Maximum horizontal spacing, 72 inches (1800 mm); maximum vertical spacing, 10 feet (3 m).
- C. 3" NPS (DN80 and Larger): Maximum horizontal spacing, 10 feet (3 m); maximum vertical spacing, 10 feet (3 m).

Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

Support vertical runs at each floor.

PIPE JOINT CONSTRUCTION

Basic pipe and tube joint construction is specified in Division 23 Section "Basic Mechanical Materials and Methods."

Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide) during brazing to prevent formation of scale.

VALVE INSTALLATIONS

Install refrigerant valves according to manufacturer's written instructions.

Install valves on suction and discharge of compressor, for gage taps at compressor inlet and outlet, for gage taps at hot-gas bypass regulators, on inlet and outlet, and on each side of strainers.

Install check valves on compressor discharge and on condenser liquid lines on multiple condenser systems.

Install refrigerant-charging (packed-angle) valve in liquid line between receiver shutoff valve and expansion valve.

Install globe valves on each side of strainers and dryers, in liquid and suction lines at evaporators, and elsewhere as indicated.

Install solenoid valves ahead of each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

- A. Electrical wiring for solenoid valves is specified in Division 26 Sections. Coordinate electrical requirements and connections.

Mount thermostatic expansion valves in any position, close to evaporator.

- A. Where refrigerant distributors are used, mount directly on expansion-valve outlet.
- B. Install valve so diaphragm case is warmer than bulb.
- C. Secure bulb to clean, straight, horizontal section of suction line using 2 bulb straps. Do not mount bulb in a trap or at the bottom of the line.
- D. Where external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

Install pressure-regulating and relief valves as required by ASHRAE 15.

SPECIALTIES APPLICATION AND INSTALLATION

Install liquid indicators in liquid line leaving condenser, in liquid line leaving receiver, and on leaving side of liquid solenoid valves.

Install strainers immediately upstream of each automatic valve, including expansion valves, solenoid valves, hot-gas bypass valves, and compressor suction valves.

Install strainers on main liquid line where multiple expansion valves with integral strainers are used.

Install moisture-liquid indicators in liquid lines between filter-dryers and thermostatic expansion valves and in liquid line to receiver.

Install permanent filter-dryers in low-temperature systems, in systems using hermetic compressors, and before each solenoid valve.

Install solenoid valves in liquid line of systems operating with single pump-out or pump-down compressor control, in liquid line of single or multiple evaporator systems, and in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into suction line when system shuts down.

Install flexible connectors at or near compressors where piping configuration does not absorb vibration.

CONNECTIONS

Electrical: Conform to applicable requirements of Division 16 Sections for electrical connections.

FIELD QUALITY CONTROL

Inspect and test refrigerant piping according to ASME B31.5, Chapter VI.

- A. Pressure test with nitrogen to 200 psig (1380 kPa). Perform final tests at 27-psig (186-kPa) vacuum and 200 psig (1380 kPa) using halide torch or electronic leak detector. Test to no leakage.

Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

Repair leaks using new materials; retest.

ADJUSTING

Adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.

CLEANING

Before installation of copper tubing other than Type ACR, clean tubing and fittings with trichloroethylene.

COMMISSIONING

Charge system using the following procedures:

- A. Evacuate refrigerant system with vacuum pump until temperature of 35 deg F (1.67 deg C) is indicated on vacuum dehydration indicator.
- B. During evacuation, apply heat to pockets, elbows, and low spots in piping.
- C. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.
- D. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
- E. Complete charging of system, using new filter-dryer core in charging line. Provide full-operating charge.
- F. Complete charging of system, using new filter-dryer core in charging line. Provide full-operating charge.

END OF SECTION

23 25 00 HVAC WATER TREATMENT

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY

This Section includes water-treatment systems for the following:

- A. Chilled-water piping (closed-loop system).
- B. Heating-water piping (closed-loop system).

Connection to existing piping systems. New piping is required to be flushed and cleaned. Add chemical to system as needed to maintain corrosion protection. Test condition of existing water prior to work starting to determine baseline conditions.

CHEMICAL FEED SYSTEM DESCRIPTION

Closed-Loop System: One injection piping connection on each system with isolating and drain valves downstream from circulating pumps, unless otherwise indicated.

PERFORMANCE REQUIREMENTS

Maintain water quality for HVAC systems that controls corrosion and build-up of scale and biological growth for maximum efficiency of installed equipment without posing a hazard to operating personnel or the environment.

Base chemical treatment performance requirements on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

Closed System: Maintain system essentially free of scale, corrosion, and fouling.

SUBMITTALS

Product Data: Include rated capacities; water-pressure drops; shipping, installed, and operating weights; and furnished products listed below:

- A. Pumps.
- B. Chemical solution tanks.
- C. Control equipment and devices.
- D. Test equipment.
- E. Chemicals.
- F. Chemical feeders.

Shop Drawings: Detail equipment assemblies indicating dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

Wiring Diagrams: Detail power and control wiring and differentiate between manufacturer-installed and field-installed wiring.

Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

Maintenance Data: For pumps, agitators, filters, system controls, and accessories to include in maintenance manuals specified in Division 1.

QUALITY ASSURANCE

Installer Qualifications: An experienced installer who is an authorized representative of the chemical treatment manufacturer for both installation and maintenance of chemical treatment equipment required for this Project.

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.

MAINTENANCE

Scope of Service: Provide chemicals and service program for maintaining optimum conditions in the circulating water for inhibiting corrosion, scale, and organic growths in the cooling, chilled-water piping and heating, hot-water piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion, including the following:

- A. Initial water analysis and recommendations.
- B. Startup assistance.
- C. Periodic field service and consultation.
- D. Customer report charts and log sheets.
- E. Laboratory technical assistance.
- F. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

EXTRA MATERIALS

Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Chemicals: Furnish quantity for one year of operation from the date of Substantial Completion.

PART 2 PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

HVAC Water-Treatment Products:
Swander.

CHEMICAL FEEDING EQUIPMENT

Positive-Displacement Diaphragm Pump: Simplex, self-priming, rated for intended chemical with 25 percent safety factor for design pressure and temperature.

- A. Adjustable flow rate.
- B. Thermoplastic construction.
- C. Fully enclosed, continuous-duty, 120-V, 60-Hz, single-phase motor.
- D. Built-in relief valve.

Chemical Solution Tanks: Chemical-resistant reservoirs fabricated from high-density opaque polyethylene with graduated markings.

- A. Molded fiberglass cover with recess for mounting pump, agitator, and liquid-level switch.
- B. Capacity: 30 gal. (114 L) or 50 gal. (189 L).

Agitator: Direct drive, 1750 rpm, mounted on tank with angle adjustment.

- A. Fully enclosed, continuous-duty, 120-V, 60-Hz, single-phase motor.
- B. Stainless-steel clamp and motor mount, with stainless-steel shaft and propeller.

Liquid-Level Switch: Polypropylene housing, integrally mounted PVC air trap, receptacles for connection to metering pump, and low-level alarm.

Packaged Conductivity Controller: Solid-state circuitry, 5 percent accuracy, linear dial adjustment, built-in calibration switch, on-off switch and light, control-function light, output to control circuit, and recorder.

Solenoid Valves: Forged-brass body, globe pattern, and general-purpose solenoid enclosure with 120-V, continuous-duty coil.

Electronic Timers: 150-second and 5-minute ranges, with infinite adjustment over full range, and mounted in cabinet with hand-off-auto switches and status lights.

Chemical Tubing: Schedule 40, PVC with solvent-cement joints; or polypropylene tubing with heat fusion.

Plastic Ball Valves: Rigid PVC or CPVC body, integral union ends, and polytetrafluoroethylene seats and seals.

Plastic-Body Strainer: Rigid PVC or CPVC with cleanable stainless-steel strainer element.

CHEMICALS

Furnish chemicals recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment.

System Cleaner: Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products.

Biocide: Chlorine release agents or microbiocides.

Closed-Loop, Water Piping Chemicals: Sequestering agent to reduce deposits and adjust pH, corrosion inhibitors, and conductivity enhancers.

PART 3 EXECUTION

WATER ANALYSIS

Perform an analysis of supply water to determine the type and quantities of chemical treatment needed to maintain the water quality as specified in "Performance Requirements" Article.

INSTALLATION

Install treatment equipment level and plumb.

Add cleaning chemicals as recommended by manufacturer.

CONNECTIONS

Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

Install piping adjacent to equipment to allow service and maintenance.

Confirm applicable electrical requirements in Division 26 Sections for connecting electrical equipment.

Ground equipment.

- 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.

FIELD QUALITY CONTROL

Engage a factory-authorized service representative to perform startup service.

- A. Inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
- B. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
- C. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.

Test chemical feed piping as follows:

- A. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
- B. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
- C. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
- D. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
- E. Repair leaks and defects with new materials and retest piping until satisfactory results are obtained.

- F. Prepare test reports, including required corrective action.

DEMONSTRATION

Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment.

- A. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
- B. Review manufacturer's safety data sheets for handling of chemicals.
- C. Review data in maintenance manuals, especially data on recommended parts inventory and supply sources and on availability of parts and service. Refer to Division 1 Section "Operation and Maintenance Data."
- D. Schedule at least four hours of training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION

23 31 13 METAL DUCTS

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air-conditioning systems in pressure classes from **minus 2- to plus 10-inch wg (minus 500 to plus 2490 Pa)**.

Related Sections include the following:

- A. Division 7 Section "Joint Sealants" for fire-resistant sealants for use around duct penetrations and fire-damper installations in fire-rated floors, partitions, and walls.
- B. Division 8 Section "Access Doors" for wall- and ceiling-mounted access doors for access to concealed ducts.
- C. Division 23 Section "Mechanical Insulation" for duct insulation.
- D. Division 23 Section "Duct Accessories" for dampers, sound-control devices, duct-mounted access doors and panels, turning vanes, and flexible ducts.
- E. Division 23 Section "Air Terminals" for constant-volume and variable-air-volume control boxes, and reheat boxes.
- F. Division 23 Section "Diffusers, Registers, and Grilles."
- G. Division 23 Section "Control Systems Equipment" for automatic volume-control dampers and operators.
- H. Division 23 Section "Testing, Adjusting, and Balancing" for air balancing and final adjusting of manual-volume dampers.

DEFINITIONS:

Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C 168. In this Section, these values are the result of the formula $\text{Btu} \times \text{in.}/\text{h} \times \text{sq. ft.} \times \text{deg F}$ or $\text{W}/\text{m} \times \text{K}$ at the temperature differences specified. Values are expressed as Btu or W.

- A. Example: Apparent Thermal Conductivity (k-Value): 0.26 or 0.037.

SYSTEM DESCRIPTION:

Duct system design, as indicated, has been used to select and size air-moving and -distribution equipment and other components of air system. Not all fittings and offsets are indicated on the plans and it is assumed that the Contractor is to include these to accommodate minor changes required for coordination and installation of duct system. Significant changes to layout or configuration of duct system must be specifically approved in writing by Engineer/Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

SUBMITTALS:

Product Data: For duct liner and sealing materials.

Shop Drawings: Show details of the following:

- A. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
- B. Duct layout indicating pressure classifications and sizes on plans.
- C. Fittings.
- D. Reinforcement and spacing.
- E. Seam and joint construction.
- F. Penetrations through fire-rated and other partitions.
- G. Terminal unit, coil, and humidifier installations.
- H. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.

Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

Record Drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.

QUALITY ASSURANCE:

Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," unless otherwise indicated.

Comply with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems," unless otherwise indicated.

DELIVERY, STORAGE, AND HANDLING:

Deliver sealant and firestopping materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

Store and handle sealant and firestopping materials according to manufacturer's written recommendations.

Deliver and store stainless-steel sheets with mill-applied adhesive protective paper maintained through fabrication and installation.

PART 2 PRODUCTS

SHEET METAL MATERIALS:

Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for 36-inch (900-mm) length or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

DUCT LINER:

General: Comply with NFPA 90A or NFPA 90B and NAIMA's "Fibrous Glass Duct Liner Standard."

Materials: ASTM C 1071 with coated surface exposed to airstream to prevent erosion of glass fibers.

- A. Thickness: 1 inch (25 mm) on all supply and return ductwork.
- B. Thermal Conductivity (k-Value): 0.26 at 75 deg F (0.037 at 24 deg C) mean temperature.
- C. Fire-Hazard Classification: Maximum flame-spread rating of 25 and smoke-developed rating of 50, when tested according to ASTM C 411.
- D. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and ASTM C 916.
- E. 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- (23-kg-) 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 (3 mm) into airstream.
 - 3. Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.
- H. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Certainteed (ToughGard R)
 - 2. Manson (Akousti-Liner)
 - 3. Manville (Line Acoustic)

SEALANT MATERIALS:

Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

- A. Joint and Seam Tape: 2 inches (50 mm) wide; glass-fiber fabric reinforced.
- B. Tape Sealing System: Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with tape to form a hard, durable, airtight seal.
- C. Joint and Seam Sealant: One-part, non-sag, solvent-release-curing, polymerized butyl sealant, formulated with a minimum of 75 percent solids.
- D. Flanged Joint Mastics: One-part, acid-curing, silicone, elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

HANGERS AND SUPPORTS:

Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for building materials.

- A. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
 - 1. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.

Hanger Materials: Galvanized, sheet steel or round, threaded steel rod.

- A. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rod or galvanized rods with threads painted after installation.
- B. Straps and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for sheet steel width and thickness and for steel rod diameters.

Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

- A. Supports for Galvanized-Steel Ducts: Galvanized steel shapes and plates.
- B. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
- C. Supports for Aluminum Ducts: Aluminum support materials, unless materials are electrolytically separated from ductwork.

RECTANGULAR DUCT FABRICATION:

General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

- A. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
- B. Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.

Static-Pressure Classifications: Unless otherwise indicated, construct ducts to the following:

- A. Supply Ducts: 3-inch wg (750 Pa).
- B. Return Ducts: 2-inch wg (500 Pa), negative pressure.
- C. Exhaust Ducts: 2-inch wg (500 Pa), negative pressure.

Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches (480 mm) and larger and 0.0359 inch (0.9 mm) thick or less, with more than 10 sq. ft. (0.93 sq. m) of unbraced panel area, unless ducts are lined.

SHOP APPLICATION OF LINER IN RECTANGULAR DUCTS:

Adhere a single layer of indicated thickness of duct liner with 90 percent coverage of adhesive at liner contact surface area. Multiple layers of insulation to achieve indicated thickness are prohibited.

Apply adhesive to liner facing in direction of airflow not receiving metal nosing.

Butt transverse joints without gaps and coat joint with adhesive.

Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

Do not apply liners in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.

Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm (12.7 m/s).

Secure liner with mechanical fasteners 4 inches (100 mm) from corners and at intervals not exceeding 12 inches (300 mm) transversely around perimeter; at 3 inches (75 mm) from transverse joints and at intervals not exceeding 18 inches (450 mm) longitudinally.

Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profile or are integrally formed from duct wall. Fabricate edge facings at the following locations:

- A. Fan discharge.
- B. Intervals of lined duct preceding unlined duct.
- C. Upstream edges of transverse joints in ducts.

Secure insulation liner with perforated sheet metal liner of same metal thickness as specified for duct, secured to ducts with mechanical fasteners that maintain metal liner distance from duct without compressing insulation.

- A. Sheet Metal Liner Perforations: 3/32-inch (2.4-mm) diameter, with an overall open area of 23 percent.

Terminate liner with duct buildouts installed in ducts to attach dampers, turning vane assemblies, and other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct wall with bolts, screws, rivets, or welds. Terminate liner at fire dampers at connection to fire-damper sleeve.

ROUND AND FLAT-OVAL DUCT FABRICATION:

General: Diameter as applied to flat-oval ducts in this Article is the diameter of the size of round duct that has a circumference equal to perimeter of a given size of flat-oval duct.

Round Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

Flat-Oval Ducts: Fabricate supply ducts with standard spiral lock seams or with butt-welded longitudinal seams according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

Double-Wall (Insulated) Ducts: Fabricate double-wall (insulated) ducts with an outer shell and an inner liner. Dimensions indicated on internally insulated ducts are inside dimensions.

- A. Thermal Conductivity (k-Value): 0.26 at 75 deg F (0.037 at 24 deg C) mean temperature.
- B. Outer Shell: Base outer-shell metal thickness on actual outer-shell dimensions. Fabricate outer-shell lengths 2 inches (50 mm) longer than inner shell and insulation, and in metal thickness specified for single-wall duct.
- C. Insulation: 1-inch- (25-mm-) thick fibrous-glass insulation, unless otherwise indicated. Terminate insulation where internally insulated duct connects to single-wall duct or uninsulated components. Terminate insulation and reduce outer duct diameter to inner liner diameter.
- D. Solid Inner Liner: Fabricate round and flat-oval inner liners with solid sheet metal of thickness listed below:
- E. Perforated Inner Liner: Fabricate round and flat-oval inner liners with sheet metal having 3/32-inch- (2.4-mm-) diameter perforations, with an overall open area of 23 percent.

Use the following sheet metal thicknesses and seam construction:

2. Ducts **3 to 8 Inches (75 to 200 mm)** in Diameter: **0.019 inch (0.5 mm)** with standard spiral seam construction.
3. Ducts **9 to 42 Inches (225 to 1070 mm)** in Diameter: **0.019 inch (0.5 mm)** with single-rib spiral seam construction.
4. Ducts **44 to 60 Inches (1120 to 1525 mm)** in Diameter: **0.022 inch (0.55 mm)** with single-rib spiral seam construction.
5. Ducts **62 to 88 Inches (1575 to 2235 mm)** in Diameter: **0.034 inch (0.85 mm)** with standard spiral seam construction.

- F. Maintain concentricity of liner to outer shell by mechanical means. Retain insulation from dislocation by mechanical means.

ROUND AND FLAT-OVAL SUPPLY AND EXHAUST FITTING FABRICATION:

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 duct.

Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from body onto branch tap entrance.

Elbows: Fabricate in die-formed, gored, pleated, or mitered construction. Fabricate bend radius of die-formed, gored, and pleated elbows one and one-half times elbow diameter. Unless elbow construction type is indicated, fabricate elbows as follows:

- A. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
- B. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from **minus 2- to plus 2-inch wg (minus 500 to plus 500 Pa)**:
 1. Ducts **3 to 26 Inches (75 to 660 mm)** in Diameter: **0.028 inch (0.7 mm)**.
 2. Ducts **27 to 36 Inches (685 to 915 mm)** in Diameter: **0.034 inch (0.85 mm)**.
 3. Ducts **37 to 50 Inches (940 to 1270 mm)** in Diameter: **0.040 inch (1.0 mm)**.
 4. Ducts **52 to 60 Inches (1320 to 1525 mm)** in Diameter: **0.052 inch (1.3 mm)**.
- C. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from **2- to 10-inch wg (500 to 2490 Pa)**:
 1. Ducts **3 to 14 Inches (75 to 355 mm)** in Diameter: **0.028 inch (0.7 mm)**.
 2. Ducts **15 to 26 Inches (380 to 660 mm)** in Diameter: **0.034 inch (0.85 mm)**.
 3. Ducts **27 to 50 Inches (685 to 1270 mm)** in Diameter: **0.040 inch (1.0 mm)**.
 4. Ducts **52 to 60 Inches (1320 to 1525 mm)** in Diameter: **0.052 inch (1.3 mm)**.
- B. Flat-Oval Mitered Elbows: Welded construction with same metal thickness as longitudinal seam flat-oval duct.
- C. 90-Degree, Two-Piece, Mitered Elbows: Use only for supply systems, or exhaust systems for material-handling classes A and B; and only where space restrictions do not permit using 1.5 bend radius elbows. Fabricate with single-thickness turning vanes.
- D. Round Elbows, **8 Inches (200 mm)** and Smaller: 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 configuration or nonstandard diameter elbows with gored construction.
- E. Round Elbows, **9 through 14 Inches (225 through 355 mm)**: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees, unless space restrictions require a mitered elbow.

Fabricate nonstandard bend-angle configuration or nonstandard diameter elbows with gored construction.

- F. Round Elbows, Larger Than 14 Inches (355 mm), and All Flat-Oval Elbows: Fabricate gored elbows, unless space restrictions require a mitered elbow.
- G. Die-Formed Elbows for Sizes through 8 Inches (200 mm) and All Pressures: 0.040 inch (1.0 mm) thick with two-piece welded construction.
- H. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
- I. Flat-Oval Elbow Metal Thickness: Same as longitudinal seam flat-oval duct specified above.
- J. Pleated Elbows for Sizes through 14 Inches (355 mm) and Pressures through 10-Inch wg (2490 Pa): 0.022 inch (0.55 mm).

Double-Wall (Insulated) Fittings: Fabricate double-wall (insulated) fittings with an outer shell and an inner liner. Dimensions indicated on internally insulated ducts are inside dimensions.

- A. Thermal Conductivity (k-Value): 0.26 at 75 deg F (0.037 at 24 deg C) mean temperature.
- B. Outer Shell: Base outer-shell metal thickness on actual outer-shell dimensions. Fabricate outer-shell lengths 2 inches (50 mm) longer than inner shell and insulation. Use the same metal thicknesses for outer duct as for uninsulated fittings.
- C. Insulation: 1-inch- (25-mm-) thick fibrous-glass insulation, unless otherwise indicated. Terminate insulation where internally insulated duct connects to single-wall duct or uninsulated components. Terminate insulation and reduce outer duct diameter to nominal single-wall size.
- D. Solid Inner Liner: Fabricate round and flat-oval inner liners with solid sheet metal of thickness listed below:
- E. Perforated Inner Liner: Fabricate round and flat-oval inner liners with sheet metal having 3/32-inch- (2.4-mm-) diameter perforations, with an overall open area of 23 percent. Use the following sheet metal thicknesses:
 - 2. Ducts 3 to 34 Inches (75 to 865 mm) in Diameter: 0.028 inch (0.7 mm).
 - 3. Ducts 35 to 58 Inches (890 to 1475 mm) in Diameter: 0.034 inch (0.85 mm).
 - 4. Ducts 60 to 88 Inches (1525 to 2235 mm) in Diameter: 0.040 inch (1.0 mm).
- F. Maintain concentricity of liner to outer shell by mechanical means. Retain insulation from dislocation by mechanical means.

PART 3 EXECUTION

DUCT INSTALLATION, GENERAL:

Duct installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts, fittings, and accessories.

Construct and install each duct system for the specific duct pressure classification indicated.

Install round and flat-oval ducts in lengths not less than 12 feet (3.7 m), unless interrupted by fittings.

Install ducts with fewest possible joints.

Install fabricated fittings for changes in directions, changes in size and shape, and connections.

Install couplings tight to duct wall surface with a minimum of projections into duct.

Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.

Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

Install ducts with a clearance of **1 inch (25 mm)**, plus allowance for insulation thickness.

Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.

Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least **1-1/2 inches (38 mm)**.

Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire damper, sleeve, 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 "Firestopping."

INSULATION:

Provide duct liner on all rectangular supply and return ductwork. All dimensions of ductwork shown on the plans are the required clear interior dimensions unless noted otherwise.

Reference Section 23 07 13 for other duct insulation requirements.

SEAM AND JOINT SEALING:

General: Seal duct seams and joints according to the duct pressure class indicated and as described in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

Pressure Classification Less Than **2-Inch wg (500 Pa)**: Transverse joints.

Seal externally insulated ducts before insulation installation.

HANGING AND SUPPORTING:

Install rigid round, rectangular, and flat-oval metal duct with support systems indicated in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

Support horizontal ducts within **24 inches (600 mm)** of each elbow and within **48 inches (1200 mm)** of each branch intersection.

Support vertical ducts at a maximum interval of **16 feet (5 m)** and at each floor.

Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

Install concrete inserts before placing concrete.

Install powder-actuated concrete fasteners after concrete is placed and completely cured.

CONNECTIONS:

Connect equipment with flexible connectors according to Division 23 Section "Duct Accessories."

For branch, outlet and inlet, and terminal unit connections, comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

FIELD QUALITY CONTROL:

Disassemble, reassemble, and seal segments of systems as required to accommodate leakage testing and as required for compliance with test requirements.

Conduct tests, in presence of Architect, at static pressures equal to maximum design pressure of system or section being tested. If pressure classifications 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.

Determine leakage from entire system or section of system by relating leakage to surface area of test section.

Maximum Allowable Leakage: Comply with requirements for Leakage Classification 3 for round and flat-oval ducts, Leakage Classification 12 for rectangular ducts in pressure classifications less than and equal to 2-inch wg (500 Pa) (both positive and negative pressures), and Leakage Classification 6 for pressure classifications from 2- to 10-inch wg (500 to 2490 Pa).

Remake leaking joints and retest until leakage is less than maximum allowable.

Leakage Test: Perform tests according to SMACNA's "HVAC Air Duct Leakage Test Manual."

ADJUSTING:

Adjust volume-control dampers in ducts, outlets, and inlets to achieve design airflow.

Refer to Division 23 Section "Testing, Adjusting, and Balancing" for detailed procedures.

CLEANING:

After completing system installation, including outlet fittings and devices, inspect the system. Vacuum ducts before final acceptance to remove dust and debris.

END OF SECTION

23 33 00 DUCT ACCESSORIES

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes the following:

- A. Backdraft dampers.
- B. Manual-volume dampers.
- C. Fire and smoke dampers.
- D. Turning vanes.
- E. Duct-mounted access doors and panels.
- F. Flexible ducts.
- G. Flexible connectors.
- H. Duct accessory hardware.

Related Sections include the following:

- A. Division 8 Section "Access Doors" for wall- and ceiling-mounted access doors and panels.
- B. Division 23 Section "Air Terminals" for constant-volume and variable-air-volume control boxes, and reheat boxes.
- C. Division 23 Section "Diffusers, Registers, and Grilles."
- D. Division 23 Section "Control Systems Equipment" for electric and pneumatic damper actuators.
- E. Division 26 Section "Fire Alarm Systems" for duct-mounted fire and smoke detectors.

SUBMITTALS:

Product Data: For the following:

- A. Backdraft dampers.
- B. Manual-volume dampers.
- C. Fire and smoke dampers.
- D. Duct-mounted access doors and panels.
- E. Flexible ducts.

Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, location, and size of each field connection. Detail the following:

- A. Special fittings and manual- and automatic-volume-damper installations.
- B. Fire- and smoke-damper installations, including sleeves and duct-mounted access doors and panels.

Product Certificates: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static-pressure loss, dimensions, and weights.

QUALITY ASSURANCE:

NFPA Compliance: Comply with the following NFPA standards:

- A. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
- B. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

EXTRA MATERIALS:

Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

- A. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 PRODUCTS

SHEET METAL MATERIALS:

Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets, commercial quality, with oiled, exposed matte finish.

Aluminum Sheets: ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14, sheet form; with standard, one-side bright finish for ducts exposed to view and mill finish for concealed ducts.

Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.

Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for 36-inch (900-mm) length or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

Low Pressure Supply Ductwork: to have a 2-inch static pressure classification (i.e., after FPAV's, SAV's and on low pressure AHU's). Medium pressure supply ductwork to have a 4-inch static pressure classification (i.e., VAV systems).

BACKDRAFT DAMPERS:

Description: Suitable for horizontal or vertical installations.

Frame: 0.052-inch- (1.3-mm-) thick, galvanized, sheet steel, with welded corners and mounting flange.

Blades: 0.025-inch- (0.6-mm-) thick, roll-formed aluminum.

Blade Seals: Neoprene.

Blade Axles: Galvanized steel.

Tie Bars and Brackets: Galvanized steel.

Return Spring: Adjustable tension.

MANUAL-VOLUME DAMPERS:

General: 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.

- A. Pressure Classifications of **3-Inch wg (750 Pa)** or Higher: End oilite bearings for ducts with 3/8" axles full length of damper blades and bearings at both ends of operating shaft. Extended quadrant locks with 3/8" dial regulators and end extended bearing plates for externally insulated ductwork. Rectangular ducts 20" and wider same as above with 16 Ga. blades, 1/2" axles and dial regulators. (Equal to Ruskin MD25/MDRS25)

Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, and suitable for horizontal or vertical applications.

- A. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of **0.064 inch (1.62 mm)** thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
B. Roll-Formed Steel Blades: **0.064-inch- (1.62-mm-)** thick, galvanized, sheet steel.
C. Extruded-Aluminum Blades: **0.050-inch- (1.2-mm-)** thick extruded aluminum.
D. Blade Axles: Galvanized steel.
E. Tie Bars and Brackets: Galvanized steel.

Low-Leakage Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, and suitable for horizontal or vertical applications.

- A. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of **0.064 inch (1.62 mm)** thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
B. Roll-Formed Steel Blades: **0.064-inch- (1.62-mm-)** thick, galvanized, sheet steel.
C. Blade Seals: Neoprene.
D. Blade Axles: Galvanized steel.
E. Tie Bars and Brackets: Galvanized steel.

Jackshaft: **1-inch- (25-mm-)** diameter, galvanized steel pipe rotating within a pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

- A. Length and Number of Mountings: Appropriate to connect linkage of each damper of a multiple-damper assembly.

Damper Hardware: Zinc-plated, die-cast core with dial and handle made of **3/32-inch- (2.4-mm)** thick zinc-plated steel, and a **3/4-inch (19-mm)** hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

FIRE DAMPERS: (static)

General: Labeled to UL 555, static (fan off), Class I.

Fire Rating: One and one-half hours.

Fire Rating: One and one-half and three hours.

Frame: SMACNA Type B with blades *out of airstream*; fabricated with roll-formed, **0.034-inch-**

(0.85-mm-) thick galvanized steel; with mitered and interlocking corners.

Mounting Sleeve: Factory- or field-installed galvanized, sheet steel.

- A. Minimum Thickness: 0.052 inch (1.3 mm) or 0.138 inch (3.5 mm) thick as indicated, and length to suit application.
- B. 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.

Mounting Orientation: Vertical or horizontal as indicated.

Blades: Roll-formed, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized, sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized steel blade connectors.

Horizontal Dampers: Include a blade lock and stainless-steel negator closure spring.

Fusible Link: Replaceable, 165 or 212 deg F (74 or 100 deg C) rated as indicated.

CEILING FIRE DAMPERS:

General: Labeled to UL 555C; comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."

Frame: 0.040-inch- (1.0-mm-) thick, galvanized, sheet steel; round or rectangular; style to suit ceiling construction.

Blades: 0.034-inch- (0.85-mm-) thick, galvanized, sheet steel with nonasbestos refractory insulation.

Fusible Link: Replaceable, 165 deg F (74 deg C) rated.

COMBINATION FIRE/SMOKE DAMPERS:

General: Labeled to UL 555S. Combination fire and smoke dampers shall be labeled for one-and-one-half-hour rating to UL 555, dynamic, Class I.

Fusible Link: Replaceable, 165 or 212 deg F (74 or 100 deg C) rated as indicated.

Frame and Blades: 0.064-inch- (1.62-mm-) thick, galvanized, sheet steel.

Mounting Sleeve: Factory-installed, 0.052-inch- (1.3-mm-) thick, galvanized, sheet steel; length to suit wall or floor application.

Damper Motors: Provide for modulating or two-position action.

- A. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
- B. 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 (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
- C. Outdoor Motors and Motors in Outside-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal

operation at **minus 40 deg F (minus 40 deg C)**.

- D. Nonspring-Return Motors: For dampers larger than **25 sq. ft. (2.3 sq. m)**, size motor for running torque rating of **150 in. x lbf (17 N x m)** and breakaway torque rating of **300 in. x lbf (34 N x m)**.
- E. Two-Position Motor: 115 V, single phase, 60 Hz.
- F. Automatic override option.
- G. Resetable Link.

SMOKE DAMPERS:

General: Labeled to UL 555S. Damper to be rated to Leakage Class III with elevated temperature rating of 250°F.

Frame and Blades: **0.064-inch- (1.62-mm-)** thick, galvanized, sheet steel.

Mounting Sleeve: Factory-installed, **0.052-inch- (1.3-mm-)** thick, galvanized, sheet steel; length to suit wall or floor application.

Damper Motors: Provide for modulating or two-position action.

- A. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
- B. 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 (17 N x m)** and breakaway torque rating of **150 in. x lbf (17 N x m)**.
- C. Outdoor Motors and Motors in Outside-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at **minus 40 deg F (minus 40 deg C)**.
- D. Nonspring-Return Motors: For dampers larger than **25 sq. ft. (2.3 sq. m)**, size motor for running torque rating of **150 in. x lbf (17 N x m)** and breakaway torque rating of **300 in. x lbf (34 N x m)**.
- E. Two-Position Motor: 115 V, single phase, 60 Hz.
- F. Automatic override option.

TURNING VANES:

Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

Manufactured Turning Vanes: Fabricate of **1-1/2-inch- (38-mm-)** wide, curved blades set **3/4 inch (19 mm)** o.c.; support with bars perpendicular to blades set **2 inches (50 mm)** o.c.; and set into side strips suitable for mounting in ducts.

All elbows, tee fittings, and short radius elbows are to be provided with turning vanes.

DUCT-MOUNTED ACCESS DOORS AND PANELS:

General: Fabricate doors and panels airtight and suitable for duct pressure class.

Frame: Galvanized, sheet steel, with bend-over tabs and foam gaskets.

Door: Double-wall, galvanized, sheet metal construction with insulation fill and thickness, and number of hinges and locks as indicated for duct pressure class. Include vision panel. Include **1-by-1-inch (25-by-25-mm)** butt or piano hinge and cam latches.

Size: Size door to be 2-inches smaller than side of duct installed on, with a maximum size of 24- by-24-inch.

Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

Insulation: 1-inch- (25-mm-) thick, fibrous-glass or polystyrene-foam board.

FLEXIBLE CONNECTORS:

General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

Standard Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches (89 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized, sheet steel or 0.032-inch (0.8-mm) aluminum sheets. Select metal compatible with connected ducts.

Extra-Wide Metal-Edged Connectors: Factory fabricated with a strip of fabric 5-3/4 inches (146 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized, sheet steel or 0.032-inch (0.8-mm) aluminum sheets. Select metal compatible with connected ducts.

Transverse Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches (89 mm) wide attached to two strips of 4-3/8-inch- (111-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized, sheet steel or 0.032-inch (0.8-mm) aluminum sheets. Select metal compatible with connected ducts.

Conventional, Indoor System Flexible Connector Fabric: Glass fabric double coated with polychloroprene.

- A. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
- B. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp, and 360 lbf/inch (63 N/mm) in the filling.

Conventional, Outdoor System Flexible Connector Fabric: Glass fabric double coated with a synthetic-rubber, weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.

- A. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
- B. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp, and 440 lbf/inch (77 N/mm) in the filling.

FLEXIBLE DUCTS

General: Comply with UL 181, Class 1.

Flexible Ducts, Uninsulated: Corrugated aluminum.

Flexible Ducts, Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-1/2-inch- (38-mm-) thick, glass-fiber insulation around a continuous inner liner.

- A. Reinforcement: Steel-wire helix encapsulated in inner liner.
- B. Outer Jacket: Glass-reinforced, silver Mylar with a continuous hanging tab, integral fibrous-glass tape, and nylon hanging cord.
- C. Outer Jacket: Polyethylene film.

D. Inner Liner: Polyethylene film.

Pressure Rating: 6-inch wg (1500 Pa) positive, 1/2-inch wg (125 Pa) negative.

ACCESSORY HARDWARE:

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 length to suit duct insulation thickness.

Splitter Damper Accessories: Zinc-plated damper blade bracket; 1/4-inch (6-mm), zinc-plated operating rod; and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.

Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches (75 to 450 mm) to suit duct size.

Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 EXECUTION

INSTALLATION:

Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.

Install volume dampers in lined duct; avoid damage to and erosion of duct liner.

Provide test holes at fan inlet and outlet and elsewhere as indicated.

Install fire and smoke dampers according to manufacturer's UL-approved written instructions.

A. Install fusible links in fire dampers.

Install duct access panels for access to both sides of duct coils. Install duct access panels downstream from volume dampers, fire dampers, turning vanes, and equipment.

A. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining accessories and terminal units.

B. Install access panels on side of duct where adequate clearance is available.

Label access doors according to Division 23 Section "Mechanical Identification."

ADJUSTING:

Adjust duct accessories for proper settings.

Adjust fire and smoke dampers for proper action.

Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

END OF SECTION

23 34 23 HVAC POWER VENTILATORS

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes the following:

- A. Centrifugal roof ventilators.
- B. In-line centrifugal fans.

Related Sections: The following Sections contain requirements that relate to this Section:

- A. Division 7 Section "Manufactured Roof Specialties" for roof curbs and equipment supports.
- B. Division 23 Section "Vibration Control" for vibration hangers and supports.
- C. Division 23 Section "Control Systems Equipment" for control devices.
- D. Division 23 Section "Disconnects and Circuit Breakers" for disconnect switches.
- E. Division 26 Section "Motor Controllers" for motor starters.

Products furnished, but not installed, under this Section include roof curbs for roof-mounted exhaust fans.

PERFORMANCE REQUIREMENTS:

Project Altitude: Base air ratings on actual site elevations.

Operating Limits: Classify according to AMCA 99.

Fan Unit Schedule: The following information is described in an equipment schedule on the Drawings.

- A. Fan performance data including capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Fan arrangement including wheel configuration, inlet and discharge configurations, and required accessories.

SUBMITTALS:

General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

Product Data including rated capacities of each unit, weights (shipping, installed, and operating), furnished specialties, accessories, and the following:

- A. Certified fan performance curves with system operating conditions indicated.
- B. Certified fan sound power ratings.
- C. Motor ratings and electrical characteristics plus motor and electrical accessories.
- D. Material gages and finishes, including color charts.

E. Dampers, including housings, linkages, and operators.

Shop Drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.

Coordination Drawings, according to Division 15 Section "Basic Mechanical Requirements," for roof penetration requirements and for reflected ceiling plans drawn accurately to scale and coordinating penetrations and units mounted above ceiling. Show the following:

- A. Roof framing and support members relative to duct penetrations.
- B. Ceiling suspension assembly members.
- C. Size and location of initial access modules for acoustical tile.
- D. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

Wiring diagrams detailing wiring for power and control systems and differentiating clearly between manufacturer-installed and field-installed wiring.

Maintenance data for power ventilators to include in the operation and maintenance manual specified in Division 1 and in Division 15 Section "Basic Mechanical Requirements."

QUALITY ASSURANCE:

Electrical Component Standard: Provide components that comply with NFPA 70 and that are listed and labeled by UL where available.

Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.

- A. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
- B. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

AMCA Compliance: Provide products that meet performance requirements and are licensed to use the AMCA Seal.

NEMA Compliance: Provide components required as part of fans that comply with applicable NEMA standards.

UL Standard: Provide power ventilators that comply with UL 705.

PROJECT CONDITIONS:

Field Measurements: Verify dimensions by field measurements. Verify clearances.

Do not operate fans until ductwork is clean, filters are in place, bearings are lubricated, and fans have been commissioned.

COORDINATION AND SCHEDULING:

Coordinate the size and location of structural steel support members.

Coordinate the installation of roof curbs, equipment supports, and roof penetrations. Roof

specialties are specified in Division 7 Sections.

EXTRA MATERIALS:

Furnish one set of belts for each belt-driven fan that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.

PART 2 PRODUCTS**MANUFACTURERS:**

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:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Centrifugal Roof Ventilators:
 - 1. Cook (Loren) Co.
 - 2. Penn Barry.
 - 3. Greenheck Fan Corp.
 - 4. Twin City Blowers.

CENTRIFUGAL ROOF VENTILATORS: (Type I – Cook ACWD)

Description: Fan shall be a spun aluminum, roof mounted, direct-drive horizontal centrifugal fan.

Construction: Fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure. The aluminum base shall have a continuously welded cub cap corners for maximum leak protection. The discharge baffle shall have a rolled bead for added strength. A two piece top cap shall have stainless steel quick release latches to provide access into the motor compartment without the use of tools, an integral conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring assembly, isolated from the unit structure with rubber vibration isolators. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Lifting lugs shall be provided to help prevent damage from improper lifting, Unit shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit tested packaging.

Wheel: Wheel shall be centrifugal backward inclined, constructed of 100 percent aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-96.

Motor: Motor shall be heavy duty type with permanently lubricated sealed ball bearing and furnished at the specified voltage, phase and enclosure.

Bearings: Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball type in a cast iron pillow block housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

Belts and Drives: Belts shall be oil and heat resistant, non-static type. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150 percent of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.

Certification: Fan shall be manufactured at than ISO 9001 certified facility. Fan shall be listed by UL 705. Fan shall bear the AMCA certified ratings seal for sound and air performance.

Accessories: The following items are required as indicated:

- A. Variable-Speed Controller: Solid-state control to reduce speed from 100 percent to less than 50 percent.
- B. Belt tensioner pulley.
- C. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
- D. Bird Screens: Removable 1/2-inch (13-mm) mesh, aluminum or brass wire.
- E. Dampers: Counterbalanced, parallel-blade, motorized dampers mounted in curb base; factory set to close when fan stops.
- F. Roof Curbs: Galvanized steel; mitered and welded corners; 2-inch- (50-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 2-inch (50-mm) wood nailer. Size as required to suit roof opening and fan base.
 - 1. Configuration: Built-in cant and mounting flange.
 - 2. Overall Height: Field verify. Curb should mount on original structural roof and extend a minimum 12 inches above metal roof.

FAN ACCESSORIES:

The following items are required as indicated:

- A. Variable-Speed Controller: Solid-state control to reduce speed from 100 percent to less than 50 percent.
- B. Belt tensioner pulley.
- C. Disconnect Switch: Non-fusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
- D. Bird Screens: Removable 1/2-inch (13-mm) mesh, aluminum or brass wire.
- E. Dampers: Counterbalanced, parallel-blade, motorized dampers mounted in curb base or fan inlet; factory set to close when fan stops.
- F. Roof Curbs: Galvanized steel; mitered and welded corners; 2-inch- (50-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 2-inch (50-mm) wood nailer. Size as required to suit roof opening and fan base.
 - 1. Configuration: Built-in cant and mounting flange.
 - 2. Overall Height: Field verify. Curb should mount on original structural roof and extend a minimum 12 inches above metal roof.

MOTORS:

Refer to Division 23 Section "Motors" for general requirements for factory-installed motors.

Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B.

Enclosure Type: The following features are required as indicated:

- A. Open dripproof motors where satisfactorily housed or remotely located during operation.
- B. Guarded dripproof motors where exposed to contact by employees or building occupants.

FACTORY FINISHES:

Sheet Metal Parts: Prime coat before final assembly.

Exterior Surfaces: Phenolic epoxy powder coating finish coat after assembly.

SOURCE QUALITY CONTROL:

Testing Requirements: The following factory tests are required as indicated:

- A. Sound Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings From Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA 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."

PART 3 EXECUTION**EXAMINATION:**

Examine areas and conditions for compliance with requirements of installation tolerances and other conditions affecting performance of the power ventilators. Do not proceed with installation until unsatisfactory conditions have been corrected.

INSTALLATION:

Install power ventilators according to manufacturer's written instructions.

Support units using the vibration-control devices indicated. Vibration-control devices are specified in Division 23 Section "Vibration Control."

- A. Secure roof-mounted fans to roof curbs with cadmium-plated hardware.
 - 1. Installation of roof curbs is specified in Division 7 Sections.
- B. Suspend units from structural steel support frame using threaded steel rods and vibration isolation springs.

Install units with clearances for service and maintenance.

Label units according to requirements specified in Division 23 Section "Mechanical Identification."

CONNECTIONS:

Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.

Electrical: Conform to applicable requirements in Division 26 Sections.

Grounding: Ground equipment. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where

manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

FIELD QUALITY CONTROL:

Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise the field assembly of components and installation of fans, including duct and electrical connections, and to report results in writing.

ADJUSTING:

Adjust damper linkages for proper damper operation.

Adjust belt tension.

Lubricate bearings.

CLEANING:

After completing installation, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.

Clean fan interiors to remove foreign material and construction debris. Vacuum clean fan wheel and cabinet.

COMMISSIONING:

Final Checks before Startup: Perform the following operations and checks before startup:

- A. Verify that shipping, blocking, and bracing are removed.
- B. Verify that unit is secure on mountings and supporting devices and that connections for piping, ducts, and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnects.
- C. Perform cleaning and adjusting specified in this Section.
- D. 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.
- E. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
- F. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in the fully open position.
- G. Disable automatic temperature-control operators.

Starting procedures for fans are as follows:

- A. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
- B. Measure and record motor voltage and amperage.

Shut unit down and reconnect automatic temperature-control operators.

Refer to Division 23 Section "Testing, Adjusting, and Balancing" for procedures for air-handling-system testing, adjusting, and balancing.

Replace fan and motor pulleys as required to achieve design conditions.

DEMONSTRATION:

Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

Review data in the operation and maintenance manuals. Refer to Division 1 Section "Contract Closeout."

Schedule training with Owner, through Architect, with at least 7 days' advance notice.

Demonstrate operation of power ventilators. Conduct walking tour of the Project. Briefly identify location and describe function, operation, and maintenance of each power ventilator.

END OF SECTION

23 36 00**AIR TERMINALS**

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes the following:

- A. Fan-powered air terminals.
- B. Single duct air terminals.

Related Sections include the following:

- A. Division 23 Section "Duct Insulation" for external insulation of air terminals.
- B. Division 23 Section "Control Systems Equipment" for control devices installed on air terminals.

SUBMITTALS:

Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each model indicated. Include a schedule showing drawing designation, room location, number furnished, model number, size, and accessories furnished.

Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.

- A. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating air outlets with other items installed in ceilings.

Maintenance Data: List of parts for each type of air terminal and troubleshooting maintenance guide to include in the maintenance manuals specified in Division 1.

QUALITY ASSURANCE:

Product Options: Drawings and schedules indicate requirements of air terminals and are based on specific systems indicated. Other manufacturers' systems with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

Listing and Labeling: Provide electrically operated air terminals specified in this Section that are listed and labeled.

- A. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
- B. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

NFPA Compliance: Install air terminals according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

Comply with NFPA 70 for electrical components and installation.

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide air terminals by one of the following:

- A. Krueger.
- B. Price.
- C. Nailor Industries Inc.
- D. Titus.
- E. Tuttle & Bailey

SINGLE-DUCT AIR TERMINALS:

Configuration: Volume-damper assembly inside unit casing. Locate control components inside protective metal shroud.

Casings: Steel sheet metal of the following minimum thicknesses:

- A. Upstream Pressure Side: 0.0239-inch (0.6-mm) steel.
- B. Downstream Pressure Side: 0.0179-inch (0.45-mm) steel.

Casing Lining: Minimum of 1 inch thick, neoprene- or vinyl-coated, fibrous-glass insulation; 1.5-lb/cu. ft. (24-kg/cu. m) density, complying with NFPA 90A requirements and UL 181 erosion requirements. Secure lining to prevent delamination, sagging, or settling.

Plenum Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.

Plenum Air Outlets: S-slip and drive connections.

Access: Removable panels to permit access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.

Volume Damper: Construct of galvanized steel with peripheral gasket and self-lubricating bearings.

- A. Maximum Damper Leakage: 2 percent of nominal airflow at 3-inch wg (750-Pa) inlet static pressure.
- B. Damper Position: Normally open.

Hot-Water Heating Coil: 1/2-inch (13-mm) copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 200 psig (1380 kPa); and factory installed.

Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.

FAN-POWERED AIR TERMINALS:

Configuration: Volume-damper assembly and fan in parallel arrangement inside unit casing. Locate control components inside protective metal shroud.

Casings: Steel or aluminum sheet metal of the following minimum thicknesses:

- A. Upstream Pressure Side: 0.0239-inch (0.6-mm) steel.
- B. Downstream Pressure Side: 0.0179-inch (0.45-mm) steel.

Casing Lining: Minimum of 1/2-inch- (13-mm-) thick, neoprene- or vinyl-coated, fibrous-glass insulation; 1.5-lb/cu. ft. (24-kg/cu. m) density, complying with NFPA 90A requirements and UL 181 erosion requirements. Secure lining to prevent delamination, sagging, or settling.

- A. Coat liner surfaces and edges with erosion-resistant coating or cover with perforated metal.

Plenum Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.

Plenum Air Outlets: S-slip and drive connections.

Access: Removable panels to permit access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn cam-lock latches.

Volume Damper: Construct of galvanized steel with peripheral gasket and self-lubricating bearings.

- A. Maximum Damper Leakage: 2 percent of nominal airflow at 3-inch wg (750-Pa) inlet static pressure.
- B. Damper Position: Normally open.

Fan Section: Galvanized-steel plenum, acoustically lined, housing direct-drive, forward-curved fan with PSC motor (unless noted otherwise), air filter, and backdraft damper.

- A. Speed Control: Multi-speed adjustable.
- B. Isolation: Fan-motor assembly on rubber isolators.

Hot-Water Heating Coil: 1/2-inch (13-mm) copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 200 psig (1380 kPa); and factory installed.

Factory-mounted and -wired controls: Mount electrical components in control box with removable cover. Incorporate single-point electrical connection to power source.

- A. Factory-mounted transformer for control voltage on electric and electronic control units with terminal strip in control box for field wiring of thermostat and power source.
- B. Wiring Terminations: Fan and controls to terminal strip, and terminal lugs to match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box sized according to NFPA 70.
- C. Disconnect Switch: Factory-mounted, fused, disconnect switch.

Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.

SOURCE QUALITY CONTROL:

Testing Requirements: Test and rate air terminals according to ARI 880, "Industry Standard for Air Terminals."

Identification: Label each air terminal with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

PART 3 EXECUTION

INSTALLATION:

Install air terminals level and plumb, according to manufacturer's written instructions, rough-in drawings, original design, and referenced standards; and maintain sufficient clearance for normal service and maintenance.

Connect ductwork to air terminals according to Division 23 ductwork Sections.

CONNECTIONS:

Install piping adjacent to air terminals to allow service and maintenance.

Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with union or flange.

Electrical: Comply with applicable requirements in Division 26 Sections.

Ground equipment.

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

FIELD QUALITY CONTROL:

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

CLEANING:

After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

COMMISSIONING:

Verify that installation of each air terminal is according to the Contract Documents.

Check that inlet duct connections are as recommended by air terminal manufacturer to achieve proper performance.

Check that controls and control enclosure are accessible.

Verify that control connections are complete.

Check that nameplate and identification tag are visible.

Verify that controls respond to inputs as specified.

DEMONSTRATION:

Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:

- A. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
- B. Review data in the maintenance manuals. Refer to Division 1 Section "Contract Closeout."
- C. Review data in the maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
- D. Schedule training with Owner, through Architect, with at least 7 days' advance notice.

END OF SECTION

23 37 13 DIFFUSERS, REGISTERS, AND GRILLES

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

Related Sections include the following:

- A. Division 10 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
- B. Division 23 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.
- C. Division 23 Section "Testing, Adjusting, and Balancing" for balancing diffusers, registers, and grilles.

DEFINITIONS:

Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.

Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.

Register: A combination grille and damper assembly over an air opening.

SUBMITTALS:

Product Data: For each model indicated, include the following:

- A. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
- B. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
- C. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size, and accessories furnished.
- D. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.

QUALITY ASSURANCE:

Product Options: Drawings and schedules indicate specific requirements of diffusers, registers, and grilles and are based on the specific requirements of the systems indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

PART 2 PRODUCTS

MANUFACTURED UNITS:

Diffusers, registers, and grilles are scheduled on Drawings.

SOURCE QUALITY CONTROL:

Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 EXECUTION

EXAMINATION:

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. Do not proceed with installation until unsatisfactory conditions have been corrected.

INSTALLATION:

Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.

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. For units installed in lay-in ceiling panels, locate units in the center of the panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

ADJUSTING:

After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

CLEANING:

After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION

23 40 00 HVAC AIR CLEANING DEVICES

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes factory-fabricated air-filter devices and media used to remove particulate matter from air for HVAC applications.

SUBMITTALS:

Product Data: Include dimensions; shipping, installed, and operating weights; 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.

Shop Drawings: Include plans, elevations, sections, and details to illustrate component assemblies and attachments.

- A. Show filter rack assembly, dimensions, materials, and methods of assembly of components.
- B. Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.

Maintenance Data: For each type of filter and rack to include in maintenance manuals specified in Division 1.

QUALITY ASSURANCE:

Product Options: Drawings indicate size, profiles, and dimensional requirements of air filters and are based on the specific system indicated.

Comply with NFPA 90A and NFPA 90B.

ASHRAE Compliance: Comply with provisions of ASHRAE 52.1 for method of testing and rating air-filter units.

Comply with ARI 850.

COORDINATION:

Coordinate size and location of filters to match ductwork and equipment.

EXTRA MATERIALS:

Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- A. Provide one complete set of start-up filters for each filter bank.
- B. Provide one complete set of filters for each filter bank to change prior to air balancing. Do not install final filters into system until just prior to balancing.
- C. Provide one complete set of filters for each filter bank at project completion, both pre-filters and final filters
- D. Provide one container of red oil for inclined manometer filter gage.

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Air Filters and Filter-Holding Systems:
 - 1. AAF International.
 - 2. Farr Co.
 - 3. Purolator.
- B. Filter Gages:
 - 1. Airguard Industries, Inc.
 - 2. Dwyer Instruments Inc.

EXTENDED-SURFACE, DISPOSABLE PANEL FILTERS: (Terminal Units)

Description: 1" factory-fabricated, medium efficiency, MERV 8, disposable, dry, extended-surface filters with holding frames.

Media: Non-woven, reinforced cotton and synthetic fabric, formed into deep-V-shaped pleats and held by self-supporting wire grid with a 96% open area.

Media is to be U.L. Class 2, and rated on ASHRAE Test Standard 52.1-92 at 20% efficiency.

Media Support Grid and Frame: Welded wire on 1" centers, bonded to the media. Frame to be a rigid, high wet strength cardboard with diagonal support members bonded to the entering and exiting side of each pleat. Frame shall be chemically bonded to the filter.

Duct-Mounting Frames: Welded, 16 gauge, galvanized steel with gaskets and spring type fasteners, and suitable for mounting together into built-up filter banks.

EXTENDED-SURFACE, DISPOSABLE PANEL PRE-FILTERS: (AHU's)

Description: 2" factory-fabricated, medium efficiency, MERV 8, disposable, dry, extended-surface filters with holding frames.

Media: Non-woven, reinforced cotton and synthetic fabric with a minimum thickness of 0.15" and a unit weight of 2.5 ounces per square yard, formed into deep-V-shaped pleats and held by self-supporting wire grid with a 96% open area.

Media is to be U.L. Class 2, and rated on ASHRAE Test Standard 52.2-1999.

Media Support Grid and Frame: Welded wire on 1" centers, bonded to the media. Frame to be a rigid, high wet strength cardboard with diagonal support members bonded to the entering and

exiting side of each pleat. Frame shall be chemically bonded to the filter.

Duct-Mounting Frames: Welded, 16 gauge, galvanized steel with gaskets and spring type fasteners, and suitable for mounting together into built-up filter banks.

FRONT- AND REAR-ACCESS FILTER FRAMES:

Framing System: Galvanized framing members with access for either upstream (front) or downstream (rear) filter servicing, cut to size and prepunched for assembly into modules. Vertically support filters prevent deflection of horizontal members without interfering with either filter installation or operation. Framing should accommodate a 2-inch (50-mm) disposable filter.

Sealing: Factory-installed, positive-sealing device for each row of filters to ensure seal between gasketed filter elements to prevent bypass of unfiltered air.

SIDE-SERVICE HOUSINGS:

Description: Factory-assembled, side-service housings, constructed of galvanized steel, with flanges to connect to duct system. Framing should accommodate a 2-inch (50-mm) disposable filter.

Access Doors: Continuous gaskets on perimeter and positive-locking devices. Arrange so filter cartridges can be loaded from either access door.

Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames to prevent bypass of unfiltered air.

FILTER GAGES:

Description: Diaphragm type with dial and pointer in metal case, vent valves, black figures on white background, and front recalibration adjustment.

- A. Diameter: 4-1/2 inches (115 mm).
- B. Range: 0- to 4.0-inch wg (0 to 1000 Pa)

Manometer-Type Filter Gage: Molded plastic with epoxy-coated aluminum scale, logarithmic-curve tube gage with integral leveling gage, graduated to read from 0- to 4.0-inch wg (0 to 1000 Pa), and accurate within 3 percent of full scale range.

Accessories: Static-pressure tips, tubing, gage connections, and mounting bracket.

PART 3 EXECUTION

INSTALLATION:

Install filter frames according to manufacturer's written instructions.

Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.

Install filters in position to prevent passage of unfiltered air.

Install filter gage for each filter bank.

Install filter gage static-pressure tips upstream and downstream from filters to measure pressure drop through filter. Mount filter gages on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gages.

Coordinate filter installations with duct and air-handling unit installations.

CLEANING:

After completing system installation and testing, adjusting, and balancing air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION

23 73 13 MODULAR CENTRAL STATION AIR HANDLERS

PART 1 GENERAL**RELATED DOCUMENTS:**

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

SUMMARY:

This Section includes central station air handling units with coils for indoor installations.

Related Sections: The following Sections contain requirements that relate to this Section:

- A. Division 23 Section "Mechanical Insulation" for field-applied equipment insulation.
- B. Division 23 Section "Air Filters" for filters and housings not an integral part of central-station air-handling units specified in this Section.
- C. Division 26 Section "Disconnect Switches and Circuit Breakers" for field-installed disconnect switches.
- D. Division 26 Section "Motor Controllers" for field-mounted alternating-current starters.
- E. Division 26 Section "Motor-Control Centers" for motor-control centers used for centralizing or grouping controls in building projects.

SUBMITTALS:

General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

Product Data for each central-station air-handling unit specified, including the following:

- A. Certified fan-performance curves with system operating conditions indicated.
- B. Certified fan-sound power ratings.
- C. Certified coil-performance ratings with system operating conditions indicated.
- D. Motor ratings and electrical characteristics plus motor and fan accessories.
- E. Material gages and finishes.
- F. Filters with performance characteristics.
- G. Dampers, including housings, linkages, and operators.

Shop Drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.

It is the responsibility of the Contractor to verify available space to install and service the equipment. Equipment larger than the area allocated for the equipment and servicing will not be accepted.

Wiring diagrams detailing wiring for power and control systems and differentiating between manufacturer-installed and field-installed wiring.

Coordination Drawings, including floor plans and sections drawn to scale. Submit with Shop Drawings. Show mechanical-room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

Field test reports indicating and interpreting test results relative to compliance with specified requirements.

Maintenance data for central station air handling units to include in the operation and maintenance manual specified in Division 1 Sections and Division 15 Section "Basic Mechanical Requirements."

QUALITY ASSURANCE:

NFPA Compliance: Central-station air-handling units and components shall be designed, fabricated, and installed in compliance with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."

ARI Certification: Central-station air-handling units and their components shall be factory tested according to the applicable portions of ARI 430, "Central Station Air Handling Units," and shall be listed and bear the label of the Air Conditioning and Refrigeration Institute (ARI).

UL and NEMA Compliance: Provide motors required as part of air handling units that are listed and labeled by UL and comply with applicable NEMA standards.

Comply with NFPA 70 for components and installation.

Listing and Labeling: Provide electrically operated components specified in this Section that are listed and labeled.

A. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

Coordination: Coordinate layout and installation of central-station air-handling units with piping and ductwork and with other installations.

DELIVERY, STORAGE, AND HANDLING:

Deliver air-handling unit as a factory-assembled module with protective crating and covering.

Lift and support units with manufacturer's designated lifting or supporting points.

SEQUENCING AND SCHEDULING:

Coordinate size and location of concrete housekeeping bases. Cast anchor-bolt inserts into base.

Coordinate size and location of structural-steel support members.

EXTRA MATERIALS:

Filters: Furnish 1 set for each central-station air-handling unit.

PART 2 PRODUCTS**MANUFACTURERS:**

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Daikin.
- B. Trane.
- C. York.
- D. AAON.

MANUFACTURED UNITS:

General Description: Factory assembled, consisting of fans, motor and drive assembly, coils, damper, plenums, filters, drip pans, and mixing dampers.

Motor and Electrical Components: Refer to Division 23 Section "Motors."

GENERAL:

Unit manufacturer to provide an integral base frame to support all sections of unit and raise unit for proper trapping. Contractor will be responsible for providing a housekeeping pad when unit base frame is not of sufficient height to properly trap unit. Unit base frames not constructed of galvanized steel shall be chemically cleaned and coated with both a rust-inhibiting primer and finished coat of rust-inhibiting enamel. Entire unit shall have a minimum 6-inch full perimeter base rail for structural rigidity and condensate trapping.

CASING:

Unit manufacturer shall ship separate segments so unit can be broken down for ease of installation in tight spaces. The entire air handler shall be constructed of galvanized steel. Casing finished to meet ASTM B117 250-hour salt-spray test. All removable panels shall be gasketed. All doors shall have gasketing around full perimeter to prevent air leakage. Contractor shall be responsible to provide connection flanges and all other framework that is needed to properly support the unit.

Casing Performance: Casing air leakage shall not exceed leak class 6 (CL = 6) per ASHRAE 111 at specified casing pressure, where maximum casing leakage (cfm/100 ft² of casing surface area) = CL X P^{0.65}.

Air leakage shall be determined at a casing static pressure of 6 inches w.g. Specified air leakage shall be accomplished without the use of caulk. Total estimated air leakage shall be reported for each unit in CFM, as a percentage of supply air, and as an ASHRAE 111 Leakage Class.

Under 55°F supply air temperature and the equipment room's ambient air temperature, condensation shall not form on the casing exterior. The AHU manufacturer shall provide tested casing thermal performance for the scheduled supply air temperature plotted on a psychrometric chart. The design condition on the exterior of the unit shall also be plotted on the chart. If tested casing thermal data is not available, AHU manufacturer shall provide, in writing to the Engineer and Owner, a guarantee against condensation forming on the unit exterior at the stated design conditions above. The guarantee shall note that the AHU manufacturer will cover all expenses associated with modifying units in the field should external condensate form on them. In lieu of AHU manufacturer providing a written guarantee, the installing contractor must provide additional external insulation on AHU to prevent condensation.

Unit casing (wall/floor/roof panels and doors) shall be able to withstand up to 1.5 times design static pressure, or 8 inches w.g., whichever is less, and shall not exceed 0.0042 inches per inch of panel span (L/240).

Floor panels shall be double-wall construction and designed to support a 250-lb. load during maintenance activities and shall deflect no more than 0.0042 inches per inch of panel span.

Unit casing panels shall be 2-inch double-wall construction, with solid galvanized exterior and solid galvanized or stainless steel interior, to facilitate cleaning of unit interior.

Unit casing panels (roof, walls, floor) and doors shall be provided with a minimum thermal resistance (R-value) of 13 Hr*Ft²*°F/BTU.

Unit casing panels (roof, walls, floor) and external structural frame members shall be completely insulated filling the entire panel cavity in all directions so that no voids exist. Panel insulation shall comply with NFPA 90A.

Casing panel inner liners must not extend to the exterior of the unit or contact the exterior frame. A mid-span, no-through-metal, internal thermal break shall be provided for all unit casing panels.

Access panels and/or access doors shall be provided in all sections to allow easy access to drain pan, coil(s), motor, drive components and bearings for cleaning, inspection, and maintenance.

Access panels and doors shall be fully removable without the use of specialized tools to allow complete access of interior surfaces.

On exterior units, the roof is to be sloped to drain.

ACCESS DOORS:

Access doors shall be 2-inch double-wall construction. Interior and exterior shall be of the same construction as the interior and exterior wall panels.

All doors downstream of cooling coils shall be provided with a thermal break construction of door panel and door frame.

Gasketing shall be provided around the full perimeter of the doors to prevent water and air leakage.

Door hardware shall be surface-mounted to prevent through-cabinet penetrations that could likely weaken the casing leakage and thermal performance.

Handle hardware shall be designed to prevent unintended closure.

Access doors shall be hinged and removable without the use of specialized tools to allow.

Hinges shall be interchangeable with the door handle hardware to allow for alternating door swing in the field to minimize access interference due to unforeseen job site obstructions.

Door handle hardware shall be adjustable and visually indicate locking position of door latch external to the section.

All doors shall be a minimum 60 inches high when sufficient height is available, or the maximum height allowed by the unit height.

A single door handle shall be provided for each door linking multiple latching points necessary to maintain the specified air leakage integrity of the unit.

PRIMARY DRAIN PANS:

All cooling coil sections shall be provided with an insulated, double-wall, stainless steel drain pan.

The drain pan shall be designed in accordance with ASHRAE 62.1 being of sufficient size to collect all condensation produced from the coil and sloped in two planes, pitched toward drain connections, promoting positive drainage to eliminate stagnant water conditions when unit is installed level and trapped per manufacturer's requirements.

The outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition.

All drain pan threaded connections shall be visible external to the unit. Threaded connections under the unit floor shall not be accepted.

Drain connections shall be of the same material as the primary drain pan and shall extend a minimum 2-1/2 inches beyond the base to ensure adequate room for field piping of condensate traps.

The installing contractor is responsible to ensure the unit is installed level, trapped in accordance with the manufacturer's requirements, and visually inspected to ensure proper drainage of condensate.

Coil support members inside the drain pan shall be of the same material as the drain pan and coil casing.

Drain pans shall be provided for heating coils.

FANS:

Fan sections shall have a minimum of one access door located on the drive side of the unit to allow inspection and maintenance of the fan, motor, and drive components.

Provide fans of type and class as specified on the schedule. Fan shafts shall be solid steel, coated with a rust-inhibiting coating, and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM. All fans shall be statically and dynamically tested by the manufacturer for vibration and alignment as an assembly at the operating RPM to meet design specifications. Fans controlled by variable frequency drives shall be statically and dynamically tested for vibration and alignment at speeds between 25 percent and 100 percent of design RPM. If fans are not factory-tested for vibration and alignment, the contractor shall be responsible for cost and labor associated with field balancing and certified vibration performance. Fan wheels shall be keyed to fan shafts to prevent slipping.

Lubrication lines for both bearings shall be extended to the drive side of the AHU and rigidly attached to support bracket with zerk fittings. Lubrication lines shall be a clear, high-pressure, polymer to aid in visual inspection.

All fans, including direct-drive plenum fans, shall be mounted on spring isolation bases. Internally-mounted motor shall be on the same isolation base. Fan and motor shall be internally isolated with spring isolators. Unit sizes up to a nominal 4000 cfm shall have one-inch springs. Unit sizes larger than a nominal 4000 cfm shall have two-inch springs. A flexible connection (e.g. canvas duct) shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements.

Fan sections containing multiple fans shall be provided as indicated on the schedule and drawings. Each fan shall operate in parallel to each other fan in the array. The fans shall be SWSI plenum type with high-efficiency AF blades. Fans shall be direct-driven. Fan wheels shall be aluminum. The horsepower characteristic of the fans shall be non-overloading.

Fan sections containing multiple fans shall be controlled using a common control signal, such as the duct static control signal, to modulate the fan speed.

Motors and Drives:

- A. All motors and drives shall be factory-installed and run tested. Fan sections with belt-drive fans shall have motors installed on a slide base to permit adjustment of belt tension. Slide base shall be designed to accept all motor sizes offered by the air-handler manufacturer for that fan size to allow a motor change in the future, should airflow requirements change.
- B. Motors shall meet or exceed all NEMA Standards Publication MG 1 – 2006 requirements and comply with NEMA Premium efficiency levels when applicable. Motors shall comply with applicable requirements of NEC and shall be UL Listed.
- C. Fan motors shall be heavy duty, NEMA premium efficient or NEMA energy efficient ODP or TEFC, operable at 115/60/1, 230/60/1, 200/60/3, 230/60/3, 460/60/3, or 575/60/3, exceeding the EPart efficiency requirements.
- D. Direct-drive fan sections shall use 2-pole (3600 rpm), 4-pole (1800 rpm), or 6-pole (1200 rpm) motors, NEMA Design B, with Class B insulation to operate continuously at 104°F (40°C) ambient without tripping of overloads. Multiple fan selections utilizing 8-pole (900 rpm) motors are unacceptable due to motor inefficiency, cost, and replacement lead times.
- E. Motors shall have a +/- 10 percent voltage utilization range to protect against voltage variation.
- F. Manufacturer shall provide for each fan a nameplate with the following information to assist air balance contractor in start up and service personnel in maintenance:
 - 1. Fan and motor bushing part number.
 - 2. Fan design RPM and motor HP.
 - 3. Belt tension and deflection.
 - 4. Center distance between shafts

COILS:

Coils section side panels shall be removable to allow for removal and replacement of coils without impacting the structural integrity of the unit.

Install coils such that headers and return bends are enclosed by unit casing to ensure that if condensate forms on the header or return bends, it is captured by the drain pan under the coil.

Coils shall be manufactured with plate fins to minimize water carryover and maximize airside thermal efficiency. Fin tube holes shall have drawn and belled collars to maintain consistent fin spacing to ensure performance and air pressure drop across the coil as scheduled. Tubes shall be mechanically expanded and bonded to fin collars for maximum thermal conductivity. Use of soldering or tinning during the fin-to-tube bonding process is not acceptable due to the inherent thermal stress and possible loss of bonding at that joint.

Construct coil casings of galvanized or stainless steel. End supports and tube sheets shall have belled tube holes to minimize wear of the tube wall during thermal expansion and contraction of the tube.

All coils shall be completely cleaned prior to installation into the air handling unit. Complete fin bundle in direction of airflow shall be degreased and steam cleaned to remove any lubricants used in the manufacturing of the fins, or dirt that may have accumulated, in order to minimize the chance for water carryover.

When two or more cooling coils are stacked in the unit, an intermediate drain pan shall be installed between each coil. The intermediate drain pan shall be designed being of sufficient size to collect all condensation produced from the coil and sloped to promote positive drainage to eliminate stagnant

water conditions. The intermediate drain pan shall be constructed of the same material as the primary drain pan.

The intermediate drain pan shall begin at the leading face of the water-producing device and be of sufficient length extending downstream to prevent condensate from passing through the air stream of the lower coil.

Intermediate drain pan shall include downspouts to direct condensate to the primary drain pan. The intermediate drain pan outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition.

Hydronic Coils:

- A. Supply and return header connections shall be clearly labeled on unit exterior such that direction of coil water-flow is counter to direction of unit air-flow.
- B. Coils shall be proof-tested to 300 psig and leak-tested to 200 psig air pressure under water.
- C. Headers shall be constructed of round copper pipe or cast iron.
- D. Tubes shall be 1/2 inch O.D., minimum 0.016 or 0.025 inch thick copper. Fins shall be aluminum.
- E. Hydronic coils shall be supplied with factory-installed drain and vent piping to the unit exterior.

FILTERS:

Provide factory-fabricated filter section of the same construction and finish as unit casings. Filter section shall have filter guides and access door(s) extending the full height of the casing to facilitate filter removal. Construct doors in accordance with Section 2.04. Provide fixed filter blockoffs as required to prevent air bypass around filters. Blockoffs shall not need to be removed during filter replacement.

Filter type, MERV rating, and arrangement shall be provided as defined in project plans and schedule.

Manufacturer shall provide one set of startup filters, one set of initial completion filters and first replacement set of filters (three sets total).

Each filter section shall be provided with a factory-installed, flush-mounted Dwyer dial-type differential pressure gauge piped to both sides of the filter to indicate status. Gauge shall maintain a +/- 5 percent accuracy within operating temperature limits of -20°F to 120°F. Filter sections consisting of pre- and post-filters shall have a gauge for each.

DAMPERS:

All dampers shall be internally mounted. Dampers shall be premium ultra low leak. Blade arrangement (parallel or opposed) shall be provided. Dampers shall be Ruskin CD60 double-skin airfoil design or equivalent for minimal air leakage and pressure drop. Leakage rate shall not exceed 4 cfm/ square foot at one inch water gauge complying with ASHRAE 90.1 maximum damper leakage and shall be AMCA licensed for Class 1A. All leakage testing and pressure ratings shall be based on AMCA Standard 500-D. Manufacturer shall submit brand and model of damper(s) being furnished, if not Ruskin CD60.

ACCESS SECTIONS:

Access sections shall be provided where indicated in the schedule and plans to allow additional access for inspection, cleaning, and maintenance of unit components. The unit shall be installed for

proper access. Procedure for proper access, inspection and cleaning of the unit shall be provided in the AHU manufacturer's maintenance manual.

DISCHARGE PLENUM SECTIONS:

Plenums shall be provided as indicated in the schedule and plans to efficiently turn air and provide acoustical attenuation. Discharge plenum opening types and sizes shall be scaled to meet pressure drop requirements scheduled and align with duct takeoffs.

Discharge plenum panels shall include an acoustical liner to meet acoustical requirements. The liner shall be fabricated from stainless steel perforated material to prevent corrosion and designed to completely encapsulate fiberglass insulation. The perforation spacing and hole size shall be such as to prevent insulation breakaway, flake off, or delamination when tested at 9000 fpm, in accordance with UL 181 or ASTM C1071. Insulation material must be resistant to fungi in accordance with ASTM C1338.

ROOF CURBS:

Manufacturer's standard, insulated with corrosion-protection coating, gasketing, factory-installed wood nailer, according to NRCA standards, and meeting ASCE 7-05 requirements.

- A. Curb Height: Minimum 14 inches.
- B. Means of attachment of the unit to the curb and the curb to the roof structure are to be provided by the unit manufacturer per ASCE 7-05 and per the Building Code wind load requirements of a minimum 90 mph wind. Curb manufacturer to provide calculations and detailed information on means of attachment (to roof and unit) certified by a licensed Engineer.

PART 3 EXECUTION**EXAMINATION:**

Examine areas and conditions to receive equipment, for compliance with installation tolerances and other conditions affecting performance of central station air handling units.

Examine roughing-in of steam, hydronic, condensate drainage piping, and electrical to verify actual locations of connections before installation.

Do not proceed with installation until unsatisfactory conditions have been corrected.

INSTALLATION:

Install central station air handling units level and plumb, according to manufacturer's written instructions.

- A. Floor-Mounted Units: Support on concrete housekeeping bases using housed-spring isolators. Secure units to anchor bolts installed in concrete housekeeping base.
- B. Suspended Units: Suspend units from structural-steel support frame using threaded steel rods and vibration isolation.

Arrange installation of units to provide access space around air-handling units for service and maintenance.

Curb Support: Install roof curb on roof structure, level, according to NRCA's written installation instructions. Install and secure rooftop units on curbs and coordinate roof penetrations and flashing with roof construction.

CONNECTIONS:

Connect condensate drain pans using Type M copper tubing. Size per Manufacturers recommendations or Code, whichever is most stringent. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

Hot and Chilled Water Piping: Conform to applicable requirements of Division 23 Section "Hydronic Piping." Connect to supply and return coil tapplings with shutoff valve and union or flange at each connection.

Electrical: Conform to applicable requirements of Division 26 Sections.

- A. Connect fan motors to wiring systems and to ground. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Temperature control wiring and interlock wiring is specified in Division 15 Section "Control Systems Equipment."

ADJUSTING:

Adjust damper linkages for proper damper operation.

CLEANING:

After completing installation, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.

Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.

COMMISSIONING:

Manufacturer's Field Inspection: Engage a factory-authorized service representative to perform the following:

- A. Inspect field assembly of components and installation of central-station air-handling units including piping, ductwork, and electrical connections.
- B. Prepare a written report on findings and recommended corrective actions.

Final Checks before Startup: Perform the following before startup:

- A. Verify that shipping, blocking, and bracing are removed.
- B. Verify that unit is secure on mountings and supporting devices and that connections for piping, ductwork, and electrical are complete. Verify that proper thermal overload protection is installed in motors, starters, and disconnects.
- C. Perform cleaning and adjusting specified in this Section.
- D. Disconnect fan drive from motor, verify proper motor rotation direction, and verify free fan wheel rotation and smooth bearings operations. Reconnect fan drive system, align belts, and install belt guards.
- E. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.

- F. Set outside-air and return-air mixing dampers to minimum outside-air setting.
- G. Comb coil fins for parallel orientation.
- H. Install clean filters.
- I. Verify that manual and automatic volume control, and fire and smoke dampers in connected ductwork systems are in fully open position.

Starting procedures for central-station air-handling units include the following:

- A. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm.
- B. Replace fan and motor pulleys as required to achieve design conditions.
- C. Measure and record motor electrical values for voltage and amperage.
- D. Manually operate dampers from fully closed to fully open position and record fan performance.

Refer to Division 23 Section "Testing, Adjusting, and Balancing" for air-handling system testing, adjusting, and balancing.

DEMONSTRATION:

Engage the services of a factory-authorized service representative to train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

- A. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Contract Closeout."
- B. Schedule training with Owner, through Architect, with at least 7 days' advance notice.

END OF SECTION

23 81 26 SPLIT-SYSTEM AIR-CONDITIONER

PART 1 GENERAL**RELATED DOCUMENTS**

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

SUMMARY

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.

Related Sections include the following:

- A. Division 23 Section "Mechanical Vibration Isolation and Seismic Restraints" for isolation pads, spring isolators, and seismic restraints.
- B. Division 23 Section "Control Systems Equipment" for control devices not packaged with units.
- C. Division 23 Section "Sequence of Operation" for control sequences affecting operation of units.

DEFINITIONS

Evaporator-Fan Unit: The part of the split-system air-conditioning unit that contains a coil for cooling (heat rejection for heating operation in heat pump units) and a fan to circulate air to conditioned space.

Compressor-Condenser Unit: The part of the split-system air-conditioning unit that contains a refrigerant compressor and a coil for condensing refrigerant (evaporator for heating operation in heat pump units).

SUBMITTALS

Product Data: Include rated capacities; shipping, installed, and operating weights; 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.

Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

Maintenance Data: For split-system air-conditioning units to include in maintenance manuals specified in Division 1.

Warranties: Special warranties specified in this Section.

QUALITY ASSURANCE

Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Other manufacturers' systems with equal performance characteristics may be considered.

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.

COORDINATION

Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations specified in Division 7 Section "Roof Accessories."

WARRANTY

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.

EXTRA MATERIALS

Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- A. Filters: One set of filters for each unit.

PART 2 PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. EMI.
- B. Mitsubishi Electronics America, Inc.; HVAC Division.
- C. Sanyo HVAC.
- D. Daikin.
- E. LG.
- F. Panasonic.

WALL- OR CEILING-MOUNTED, EVAPORATOR-FAN COMPONENTS

Cabinet: Enameled steel with removable panels on front and ends, and discharge drain pans with drain connection.

Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

Fan and Motor: Centrifugal fan, directly driven by multispeed, electric motor with integral overload protection; resiliently mounted.

Filters: Throwaway.

AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.

Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid sub-cooler.

Fan: Aluminum-propeller type, directly connected to motor.

Motor: Permanently lubricated, with integral thermal-overload protection.

Low Ambient Kit: Permits operation down to 0 deg F.

Mounting Base: Polyethylene.

ACCESSORIES

Thermostat: Low voltage with subbase to control compressor and evaporator fan.

Automatic-reset timer to prevent rapid cycling of compressor.

Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

PART 3 EXECUTION

INSTALLATION

Install units level and plumb.

Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

Install roof-mounted compressor-condenser components on equipment supports specified in Division 7 Section "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

Connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

CONNECTIONS

Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

Install piping adjacent to unit to allow service and maintenance.

Unless otherwise indicated, connect piping with unions and shutoff valves to allow units to be disconnected without draining piping. Refer to piping system Sections for specific valve and specialty arrangements.

Ground equipment.

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.

FIELD QUALITY CONTROL

Installation Inspection: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections, and to prepare a written report of inspection.

Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new components, and retest.

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

COMMISSIONING

Engage a factory-authorized service representative to perform startup service.

Verify that units are installed and connected according to the Contract Documents.

Lubricate bearings, adjust belt tension, and change filters.

Perform startup checks according to manufacturer's written instructions and do the following:

- A. Fill out manufacturer's checklists.
- B. Check for unobstructed airflow over coils.
- C. Check operation of condenser capacity-control device.
- D. Verify that vibration isolation devices and flexible connectors dampen vibration transmission to structure.

DEMONSTRATION

Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

- A. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining units.
- C. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
- D. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
- E. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION

SECTION 26 05 00 - BASIC METHODS AND REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS:

- A. The General Conditions, Supplementary General Conditions, General Requirements, and Special Conditions shall be and are hereby made a part of this Section of the specifications.
- B. In case of conflicts between the electrical drawings and Division 26 of these specifications, the more stringent requirements shall govern. In all cases, notify the Engineer for direction.
- C. The requirements of SECTION 26 05 00 - BASIC METHODS AND REQUIREMENTS establish minimum requirements, apply to, and are hereby made a part of all sections of Division 26, 27, 28 of this specification.
- D. The Contractor shall be responsible for excavation of all earth, soil, and rock conditions at the site. Review the elevations and soil boring logs and include all associated costs.
- E. Unless noted otherwise on the Drawings, or elsewhere in Division 26, 27, 28 Specifications, the singular words 'Provide', 'Furnish', or 'Install' noted on the drawings or in these Specifications shall mean to completely furnish, install, and connect each item, and if such is a part or component of a system the entire system shall be functional with all items and components provided. Unless noted otherwise on the Drawings, or elsewhere in Division 26 Specifications, any reference to 'wiring' noted on the drawings or in these Specifications shall mean both raceways and conductors or cables.

1.2 DESCRIPTION:

- A. The electrical work shall include all labor, materials, tools, transportation, equipment, services and facilities, required for the complete, proper and substantial installation of all electrical work shown on the plans, and/or outlined in these specifications. The installation shall include all materials, appliances, and apparatus not specifically mentioned herein or noted on the drawings but which are necessary to make a complete working installation of all electrical systems.
- B. All of the electrical related work required for this project (unless specified otherwise) is a part of the Electrical Contract price but is not necessarily specified under this division of the specifications or shown on the electrical drawings. Therefore, all divisions of the specifications and all drawings shall be consulted.
- C. The floor plan drawings are schematic only and are not intended to show the exact routing of raceway systems between devices, lighting, and equipment unless dimensions are noted on the drawings. Routing of raceways overhead or below floor shall be as shown on the drawings, unless approved otherwise by the Engineer. Final routing of raceway systems between devices, lighting, and equipment will be governed by field conditions (structural members, mechanical equipment, ductwork, etc.) and shall be determined by the Contractor and approved by the Architect. Any changes in routing shall not change the design of the raceway system.
- D. The floor plan drawings showing device and equipment locations are schematic only and are not intended to show exact locations unless dimensions are noted on the drawings. The Contractor shall review all contract drawings that may affect the location of devices

and equipment to avoid possible interference and permit full coordination of all work. The right to make any reasonable change in location within 6'-0", is reserved by the Architect up until the time of rough-in at no extra cost.

- E. Furnish and install electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings. Capacities and ratings of transformers, cable, switchgear, panelboards, motor control, and other items, arrangement for specified items in general are shown on drawings.
- F. Electrical service entrance equipment (arrangements for temporary and permanent connections to the power company's system) shall conform to the power company's requirements. Coordinate fuses, circuit breakers and relays with the power company's system, and obtain power company approval. Provide all required temporary building power and lighting. Remove when finished. Installation of temporary power and lighting shall comply with N.E.C. and OSHA requirements.
- G. Ampacities specified or shown on the drawings are based on copper conductors, with EMT conduit accordingly sized. If other conduit or raceway types are used, adjust conduit or raceway sizes accordingly.
- H. This Contractor shall coordinate his work under this division of the specifications with the work of other trades wherein it may be interrelated. His work shall be done in such an order that there will be no interference in installing, nor delay in completion, of any part or parts of each respective trade, thereby permitting all construction work to proceed in its natural sequence without unnecessary delay.
- I. Before submitting his bid, the Contractor shall familiarize himself with the rules of all governing bodies having jurisdiction and shall notify the Architect in submitting his bid, if in his opinion, any work or material specified is contrary to such rules. Otherwise, the Contractor shall be responsible for the approval of all work and materials and, in case the use of any material specified is not permitted, a substitute shall be approved by the Engineer and shall be provided at no increase in cost.
- J. The drawings have been prepared to cover all electrical work under this contract. The Contractor is referred to all other contract drawings to guide him in the proper installation of his work.
- K. The Contractor shall fully familiarize himself with the floor drawings, elevations, details of construction, feeders, fixtures, conduit, wiring, service, etc., insofar as it may affect the installation of the work under this specification in order that all necessary materials and labor may be provided even though not specifically referred to on the drawings or called for in the specifications.
- L. As the drawings are generally diagrammatic, the final layout of the work shall be subject to the approval of the Architect but the Contractor shall be responsible without increase in contract price for the coordination of all work under various divisions of the specifications.
- M. This Contractor shall confer with other Contractors installing work which may affect his work and must arrange his conduit, etc., in proper relation to such work. Any damage resulting from his neglect to do so must be paid for by the Contractor.
- N. Where necessary to fit and center with paneling of ceilings and wall spaces, the Contractor must, at his own expense, shift the lighting outlets or other outlets as required by the Architect.

- O. All outlets shall be set in such a manner as to finish flush with wall and ceiling lines unless marked to be exposed or surface mounted on the drawings. The height of brackets, switches, outlets, etc., are to be as directed.
- P. The Electrical Contractor shall confirm the exact electrical requirements for all equipment supplied by others and installed or connected by the Electrical Contractor. The specific work performed for the installation of any equipment shall be in conformance with the requirements established by the shop drawings of the equipment supplied. In the event the shop drawings establish requirements distinctly different than the requirements shown in the contract documents, the Contractor shall be entitled only to an adjustment of the difference between the work shown and the work required with full credit for labor and materials shown on the original drawings.
- Q. The Electrical Contractor shall provide all trenching and backfilling for underground conduits. Unless noted otherwise in other divisions of these specifications, all trenches shall be backfilled and compacted with material defined by the United Soil Classification as ML or CL (silt and clay of low to medium plasticity). Compaction shall be to 90% of ASTM D698.

1.3 MINIMUM REQUIREMENTS:

- A. Codes Rules and Regulations: Execute all work under ADA, the latest rules and regulations of the National Electrical Code Standard of the National Board of Fire Underwriters, the National Fire Protection Association, and with all laws, regulations and ordinances of the County, State, City, and the Utility Company.
- B. Codes shall govern in case of any direct conflict between codes, plans and specifications; except when plans and specifications require higher standards than those required by code. Variance from the plan and specifications made to comply with code must be approved by the Architect. If approved they shall be made with no increased cost to the Owner.
- C. This Contractor shall provide and install only the brands of materials and equipment specified herein, or equipment approved by written addendum by the Architect-Engineer as equal. All material and equipment shall be listed and labeled by Underwriters Laboratories, Inc., indicating compliance with nationally recognized standards and/or tests.

1.4 STANDARDS:

- A. All material and equipment shall be listed, labeled or certified by Underwriters Laboratories, Inc., where such standards have been established. Equipment and material which are not covered by UL Standards will be accepted provided equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as NEMA, or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings.
- B. Definitions:
 - 1. Certified: Equipment is "certified" if:

- a. Equipment has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards, or to be safe for use in a specified manner.
 - b. Production is periodically inspected by a nationally recognized testing laboratory.
 - c. It bears a label, tag, or other record of certification.
2. Nationally recognized testing laboratory: A testing laboratory which is approved, in accordance with OSHA regulations, by the Secretary of Labor.

1.5 QUALIFICATIONS (PRODUCTS AND SERVICES):

- A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.
- B. Product Qualification:
 1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
 2. The Engineer reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.
- C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will respond within two hours of receipt of notification that service is needed. Submit name and address of service organization.

1.6 MANUFACTURED PRODUCTS:

- A. Materials and equipment furnished shall be new, of best quality and design, free from defects, of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts should be available. All items used on this project shall be free of asbestos, PCB, and mercury material.
- B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.
- C. Equipment Assemblies and Components:
 1. Components of an assembled unit need not be products of the same manufacturer unless indicated otherwise.
 2. Manufacturers of equipment assemblies, which include components made by others, shall be completely responsible for the final assembled unit.
 3. Components shall be compatible with each other and with the total assembly for the intended service.
 4. Constituent parts which are similar shall be the product of a single manufacturer.
- D. Factory and Field wiring shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Testing is Specified:

1. The Engineer shall have the option of witnessing factory tests. The Contractor shall notify the Engineer a minimum of 15 working days prior to the manufacturer making the factory tests.
2. Four copies of certified test reports containing all test data shall be furnished to the Engineer prior to final inspection and not more than 90 days after completion of the tests.
3. When equipment fails to meet factory test and re-inspection is required, the Contractor shall be liable for all additional expenses, including expenses of the Engineer.

1.7 EQUIPMENT PROTECTION:

- A. Equipment and material shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain. Temporary raceways shall be kept closed and all raceways shall be installed clean and free from dirt and grease.
- B. During installation, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter and be vacuum cleaned both inside and outside before testing, operating and painting.
- C. Damaged equipment shall be, as determined by the Engineer, placed in satisfactory operating condition or be returned to the source of supply for repair or replacement.
- D. Painted surfaces shall be protected with factory installed removable heavy Kraft paper, sheet vinyl or equal.
- E. Damaged paint on equipment and materials shall be restored to the original quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.8 GENERAL WORK REQUIREMENTS:

- A. Arrange, phase and perform work to assure electrical service both temporary and permanent for buildings at all times.
- B. Coordinate location of equipment and conduit with other trades to minimize interference.
- C. Examination of Site:
 1. Visit the site, inspect the existing conditions and check the drawings and specifications so as to be fully informed of the requirements for completion of the work.
 2. Lack of such information shall not justify an extra to the contract price.
- D. Permits:
 1. Obtain and pay for all licenses and permits, fees, inspection and certificates required for the execution of this work.
 2. Pay fees and charges for connection to outside services and use of property.
 3. Deliver permits and certificates to the Architect to be transmitted to the Owner.

E. Services:

1. This Contractor shall pay for all expenses, deposits, reimbursements, etc., required by the local rules and codes for the service to the buildings, complete and ready for use.
2. Consult power company for their requirements and for coordinating with their installation. Contractor shall provide any work thus required beyond that indicated by drawings and/or specifications and pay for costs incurred for Utility Company to install both temporary and permanent service to the project. All temporary wiring shall be installed per the National Electrical Code. Verify costs with Utility Co. prior to bidding. Verify complete installation and locations of pad mount or pole mount transformers with the local electric utility company and bid installation to comply with their requirements. Contractor shall provide guard posts around electrical transformers and electrical pedestals per Utility Company standards. Contractor shall provide warning tapes above primary and secondary conduits per National Electrical Code. Verify routing of primary and secondary conduits with Utility Co. prior to installation.
3. This Contractor shall consult all local departments to verify requirements and bid installation of service in accordance with local codes and Utility company rules and regulations.
4. This Contractor shall bear all expense involved for the complete telephone service conduit installation and pull wire ready for cable installation. Verify complete installation with the local telephone company and bid installation to comply with their requirements.

F. Main Service:

1. Primary: See the plans. (Existing)
2. Secondary: See the plans. Voltage will be, 277/480-volt, 3-phase, 4-wire, WYE, 120/208-volt, 3-phase, 4-wire, WYE, (Existing)

G. Responsibility:

1. This Contractor will be held responsible for any and all damage to any part of the building or to the work of other contractors, as may be caused through this contractor's operation.
2. Any mutilation of building finishes or equipment initiated by electrical construction shall be properly corrected by the respective finishing contractor and paid for by the Electrical Contractor.
3. The operation of the temporary power and the permanent electrical system shall be the responsibility of this Contractor until acceptance of the building by the Owner, unless noted otherwise.

H. Work to be done by the General Contractor:

1. Build in all openings, sleeves, chases, etc., for conduit and equipment as established, furnished and set by this Contractor. The General Contractor shall seal or grout all openings after this Contractor has installed the conduits.

2. Build in bolts, brackets, hangers etc., for work established, furnished and set by this Contractor.
 3. All concrete work required for equipment furnished and set by this Contractor including clean up pads under electrical gear, fixture bases, transformer bases, etc.
 4. Painting: All painting of electrical equipment installed in finished areas shall be done by the General Contractor. Painting will not be required on receptacles, switches, circuit breakers etc. All fixtures and exterior poles specified to be factory-primed shall be painted by General Contractor. Paint all Wiremold, exposed conduit and equipment, etc., to match final wall or ceiling colors.
 5. Provide fireproofing above fixtures located in fire rated ceilings per U.L. requirements.
 6. Pay all utility costs for operation of electrical system during construction until acceptance of building by the Owner.
- I. Work to be done by the Mechanical Contractor:
1. The Mechanical Contractor shall furnish wiring diagrams and temperature control drawings of all equipment furnished to the Electrical Contractor. (Catalog information is unacceptable, provide point to point drawings.).
 2. The Mechanical Contractor shall furnish and install all control equipment requiring connections to air, water, steam, etc., such as pneumatic electric relays, remote bulb temperature controls, solenoid valves, aquastats and pressure controls.
 3. The Mechanical Contractor shall reimburse the Electrical Contractor for any changes in system design i.e.; control or equipment which affects the Electrical Contractor. Also refer to equipment connections, controls and instrumentation in 26 05 00.
- J. Workmanship and coordination:
1. Make installation substantially as shown on the plans.
 2. Make alterations in location of apparatus or conduit as may be required to conform to building construction without extra charge.
 3. Mechanical equipment service clearances and electrical apparatus service clearances as specified in their respective manufacturer's product data shall be maintained free from conduit.
 4. Cooperate with other trades in their installation of work.
 5. Complete the installation in a workmanlike manner, completely connected and ready to give proper and continuous service.
 6. Use only experienced licensed electricians.
- K. Cutting and patching:
1. Notify the General Contractor in ample time, of the location of all chases, sleeves, and other openings required in connection with the work of this contract.

2. Cutting and patching made necessary because of failure to comply with the above shall be done by the General Contractor at the expense of the Electrical Contractor.
 3. When it is necessary for the Electrical Contractor to cut building materials, it shall be done in a neat and workmanlike manner meeting with the approval of the Architect and by the mechanics of the particular trade involved.
 4. Holes through concrete shall be carefully drilled with a "Concrete Termite" drill. A Star Drill or Air Hammer will not be permitted. Structural members shall not be cut without approval from the Architect.
 5. Any penetrations through the roof shall be made with "Stoneman" flashing connections as manufactured by Stoneman Engineering and Manufacturing Co., Inglewood, Calif., or as approved by the Architect.
 6. Any penetrations made in exterior or basement foundation walls shall be sealed with Thunderline "Link-Seal" connections, as manufactured by Thunderline Corporation, Wayne, Michigan.
 7. Any holes or voids created in floors, ceilings and walls, including any spaces or gaps around conduit or equipment passing through such areas, which compromise the applicable rating of the floors, ceilings or walls, shall be sealed with an intumescent material equal to "3M Fire Barrier Caulk, Putty or Strip Sheet", "Carborundum Fiberfrax Fyre Putty", "Tremco X-ferno Fire Products", or "Rectorseal Metacalk". Material equal to the above and meeting U.L. 1479 may be used. All installations shall be per manufacturer's exact instructions.
- L. Manufacturers instructions:
1. Apply, install, connect, erect, use, clean, and condition articles, materials and equipment as directed by the manufacturer.
- M. Temporary electrical:
1. Make arrangements with electric utility for temporary service.
 2. Provide materials, equipment, labor to install, modify, maintain (and upon completion of project, remove) safe temporary electrical power and lighting systems per OSHA standards and NEC requirements.
 3. Provide sufficient capacity for construction tools, equipment, temporary ventilation and lighting.
 4. Distribute systems throughout building and construction area of site such that an extension cord no longer than 100' will reach any work area. Open branch systems permitted where permitted by the National Electrical Code and OSHA. Provide temporary services to all construction offices as required.
 5. Employ permanent systems as they are completed and available.
 6. Provide metering of temporary service. All temporary utility costs will be paid by the Contractor.

7. All temporary electrical services shall be removed within 30 days after completion of the building, or 30 days after the premises are used or occupied for which the temporary permit was issued.

N. Demolition:

1. Where remodeling and renovation work is a part of the project, the following shall apply, unless noted otherwise on the drawings:
 - a. All items noted to be removed shall be removed complete back to point of supply including conductors and exposed lengths of conduit and raceways. Any raceways removed that are routed into the floor shall be cut off flush with the floor surface and the floor patched for a flat smooth floor surface. All items to remain on circuits where other items are noted to be removed shall be re-circuited as required to maintain continuity of circuit or system. All light fixtures, equipment, receptacles, devices, fire alarm and nurse call devices, door security devices, and sound system devices noted to be removed and not relocated shall be offered to the Owner. If the Owner elects not to retain these items, they shall become Contractor salvage and shall be removed from the job site. The Contractor shall remove from the job site all other items noted to be removed (verify all items with Owner). Where existing flush mounted devices are noted to be removed from walls to remain, remove device, coverplate, and conductors and install blank cover plate over flush backbox. Electrical Contractor shall remove existing coverplates for all existing devices to remain in remodeled and renovated areas that will receive new wall finishes and reinstall cover plates after new wall finishes are complete. All existing light fixtures and devices not shown or indicated otherwise on the drawings in existing areas are to remain.
 - b. Electrical Contractor shall remove all existing light fixtures, devices and wiring from all existing walls, partitions, and ceilings to be removed, and shall remove all existing light fixtures and wiring in rooms where new lighting is shown, unless noted otherwise on the drawings.
 - c. Electrical Contractor shall review all specifications and all drawings to coordinate installation of new equipment and devices of other trades with existing conditions. Remove and relocate existing raceways, conductors, and boxes as required for installation of new equipment or devices.
 - d. Schedule all downtimes associated with any new service revisions a minimum of one (1) week prior to interruption of services. No interruptions of any electrical work shall be made without prior consent of the Owner. Contractor shall submit to the Owner a schedule of downtimes for the Owners review and approval.

1.9 EQUIPMENT INSTALLATION AND REQUIREMENTS:

- A. The Contractor shall obtain from the Architectural and Structural drawings the exact location and size of spaces available for his apparatus and material and shall install them accordingly. In case the space allowed is not sufficient, or an obstruction interferes with placing them as shown or specified, the Contractor shall obtain instructions from the Architect and shall install them as directed without extra charge. These provisions refer

only to exactness of positions that cannot be determined from the drawings and do not permit placing apparatus distinctly different from that shown on the drawings.

- B. Working spaces shall not be less than specified in the National Electrical Code for all voltages specified.
- C. Inaccessible Equipment:
 - 1. Where the Engineer determines that the Contractor has installed equipment without proper clearances or not readily accessible for operation and maintenance, equipment shall be removed and reinstalled as directed at no additional cost to the Owner.
 - a. Install access panels as approved by the Architect to provide access to all equipment, J-boxes and outlets located in non-accessible spaces. Panels shall be flush locking type with a fire rating equal to the ceiling system.
 - 2. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping, and ductwork. Outlet and box covers shall be removable by using regular length (8") screw drivers.
- D. Distribution Equipment:
 - 1. All items of Electrical Distribution Equipment (switchboards - panelboards - disconnects) shall be of one manufacturer, unless specifically noted on the drawings, in the specifications, or approved by written addendum by the Engineer. Intermixing of distribution equipment by different manufacturers will not be permitted.
 - 2. If shown on the drawings, provide a surge arrester for lightning protection on each service entrance for each building. Refer to drawings for voltage and phasing of service. Arrester shall be located within or adjacent to the main switch, panel or switchboard enclosure and connected with 12" maximum leads. Surge Arrester shall be equal to Current Technology SEL200-DM-L3 Series.
 - 3. Equipment layouts on the drawings are based on one manufacturer. Verify all actual equipment sizes with equipment manufacturer prior to bidding.
 - 4. If layout changes are required due to differing electrical manufacturers equipment size, they must be submitted to and approved by the Engineer. National Electric Code working clearances must be maintained at all times. Extra remuneration will not be allowed for layout changes that differ from those shown.
 - 5. Provide and install all steel supports as required for mounting of electrical equipment.
 - 6. Anchor all free standing electrical equipment including switchboards, switchgear, substations, motor control centers, paralleling gear, transfer switches, transformers, etc. to the floor with plated, 1/2" diameter minimum, anchor bolts or as recommended by the manufacturer.

1.10 EQUIPMENT CONNECTIONS, CONTROLS AND INSTRUMENTATION:

- A. General: The following applies to all electrical power and control connections for all equipment requiring electrical installation work provided by others.
- B. The Electrical Contractor shall furnish, install and connect all wiring, conduit, boxes, toggle switches, thermal switches, disconnect switches, remote push-button stations not included in magnetic starters, etc., for all equipment requiring electrical power that is furnished by other contractors and/or the Owner, as required for a complete and operating system. The Electrical Contractor shall receive, install and connect all magnetic starters and controllers, capacitors, power factor correction devices, transformers, alarms, bells, horns, relays, remote switches, etc., for equipment supplied by others, (i.e. starters, capacitors or power factor correction devices for mechanical equipment, etc.). In general all major equipment will be specified to be factory prewired with only service and interlocking required at the site by the Electrical Contractor; however he shall check all divisions of the specifications to verify if the equipment is specified factory prewired and if not, then it shall be the responsibility of the Electrical Contractor to provide the complete wiring of the equipment in accordance with wiring diagrams, and temperature control drawings provided by the other contractors and/or the Owner, to the Electrical Contractor. All interlocking of equipment shall be by the Electrical Contractor.
- C. All line and low voltage wiring and connections required to control the equipment and/or dampers are a part of this section. All wiring shall be in conduit. Provide and install line or low voltage wiring to all dampers as required for system operation. All low voltage wiring, conduit, connections and/or terminations are by the Electrical Contractor unless specifically noted otherwise within the bidding documents.
- D. The Electrical Contractor shall provide to each Mechanical Control Panel a 120 volt control power supply; #12 Ga. CU. THHN/THWN in 1/2"C. minimum at all points required by controls, instrumentation and sprinkler risers. Circuit as shown on the plans or to the nearest 120 volt panel if no circuiting is indicated. Provide 20 Amp. breakers unless otherwise indicated. Each control panel shall be on a separate circuit unless otherwise indicated. If the controlled equipment is fed from the emergency system, then the control power supply must feed from the emergency system. Electrical Contractor to provide at each Mechanical Control Panel a telephone outlet and conduit as described in Section 27 05 00.
- E. The Contractor shall become familiar himself with the equipment to be furnished by the other Contractors and/or the Owner in connection with this work and include provisions for such connections and work in the Contractor's price. Extra remuneration will not be allowed for such work.
- F. Connections to all equipment have been designed from units as specified on the drawings or in the specifications. In the event equipment or control differs on approved shop drawings it shall be the responsibility of the Supplying Contractor to coordinate electrical connections to the units and reimburse Electrical Contractor for any changes in system design. These changes shall not involve additional cost to the Owner.
- G. Review all plans, specifications, and approved shop drawings of all trades to verify all equipment connections that are required by mechanical and/or other contractors. Although the electrical drawings will show equipment connection requirements, it is the Electrical Contractor's responsibility to connect all equipment furnished by other Contractor's at no extra cost to the Owner, even if this equipment connection is not shown on the electrical drawings. Coordinate all required connections not shown on the electrical drawings with the Engineer.

- H. Electrical Contractor to provide and install all boiler remote shut down switches and chiller remote shut down switches as required by Codes. Connect to equipment as required. Install nameplates at switches indicating use. Mount switches at 4'-0" AFF.
- I. Service receptacles and disconnect switches mounted on mechanical equipment shall be located as not to obstruct access doors to equipment. Provide weatherproof-in-use covers on receptacles at exterior HVAC units, whether or not the receptacles are furnished with the equipment.

1.11 NAMEPLATES:

- A. General: The following items shall be equipped with nameplates:
 - 1. Disconnect switches (fused or nonfused), transformers, switchgear, switchboards, panelboards, separately mounted circuit breakers, starters, contactors, relays, junction boxes and pull boxes.
 - 2. Special Electrical Systems (fire alarm, sound system, emergency system, etc.) shall be so identified at junction and pull boxes, terminal cabinets and equipment racks with a permanent, waterproof means of identification. (Example – FIRE ALARM). Free hand lettering or adhesive tape type label markers will not be acceptable.
 - 3. Wall switches or other control devices controlling equipment or special lighting configuration shall have either engraved wall plates or shall be provided with engraved nameplates.
 - 4. All devices on the emergency system shall be 'Red' with coverplates to match remainder of devices in the building. Coverplate to be engraved with panel name and circuit number.
- B. Inscription: Nameplates shall adequately describe the function or use of the particular equipment involved. Nameplates for panelboards and switchboards shall include the panel designation, voltage, phase, A.I.C. rating of the devices, color coding of conductors, and location that panel is fed from. (See schedules, one-line diagram, and conductor color coding). For example, "Panel A 120/208 V, 3-Phase, 4-Wire, 10,000 A.I.C. Phase A: Black, Phase B: Red, Phase C: Blue, Neutral: White, Ground: Green, Fed From Panel MDP".

The name used for a machine nameplate shall be the same as the one used on the machine's motor starter, disconnect and P.B. station nameplates. Nameplates for fused switches and panels shall also indicate fuse type and size. All panelboards fed from the emergency system shall be labeled "Emergency System", in addition to the instructions listed above.

- C. Construction: Nameplates shall be laminated phenolic plastic white front and back with black core. Nameplates for emergency system panelboards and transfer switch shall be laminated phenolic plastic red front and back with white core. Lettering shall be engraved through front layer to form 1/4" black characters. Nameplates shall be securely fastened to the equipment to be identified, with No. 4 Phillips, round head, cadmium plated, steel self tapping screws or nickel plated brass bolts. Motor nameplate may be nonferrous metal not less than 0.03 inches thick, die stamped. In lieu of separate plastic nameplates, engraving directly on device plates is acceptable. Letters engraved thus, shall be filled with contrasting enamel. All nameplates and their installation are part of this work. Free hand lettering or Dymo Label marker will not be acceptable.

1.12 MATERIALS OF APPROVED EQUAL:

- A. Where items of equipment and/or materials are specifically identified herein by a manufacturer's name, model or catalog number, only such specific items may be used in the base bid, except as hereinafter provided.
- B. Unless requests for changes in base bid specifications are received, approved and noted by written addendum prior to the opening of bids, the successful contractor will be held to furnish specified items.
- C. After contract is awarded, changes in specifications shall be made only as defined under "Substitution of Equipment".

1.13 SUBSTITUTION OF EQUIPMENT:

- A. After execution of the contract, substitution of equipment of makes other than those specifically named in the contract documents, may be approved by the Engineer, only if the equipment named in the specifications cannot be delivered to the job in time to complete the work in proper sequence and due to conditions beyond control of the Contractor. Provide documentary proof in writing from the manufacturer that the specified equipment will not be available in time. If the Contractor is responsible for the delay, the substitution will not be approved.
- B. Requests for substitutions must be accompanied by documentary proof of equality or difference in price and delivery, if any, in form of certified quotations from suppliers of both specified and proposed equipment.
- C. The Owner shall receive all benefits of the difference in cost involved in any substitution, and the contract altered by change order to credit Owner with any savings so obtained.

1.14 SUBMITTALS: In accordance with Section SAMPLES AND SHOP DRAWINGS, Contractor shall, within 15 days after award of contracts, begin sending to the General Contractor for review submittals containing the following:

- A. The Engineer's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.
- B. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Engineer to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.
- C. Submittals shall be complete and submitted together for each section. Individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assemble as a whole. Partial submittals will not be considered for approval.
 - 1. Mark the submittals, "SUBMITTED UNDER SECTION_____". Mark out all statements on sheets that do not apply otherwise. The Engineer may select options and equipment not originally specified. All options that are not marked out will be assumed that the Contractor will furnish the same.
 - 2. Submittals shall be marked to show specification reference including the section and paragraph numbers.

3. Submit each section separately.
 4. Mark catalog cuts to indicate equipment, capacities, finishes, sizes, etc. Each individual item shall have its own sheet provided for approval. (Example: Separate sheets for each panelboard.)
- D. The submittals shall include the following:
1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
 2. Elementary and interconnection wiring diagrams for communication and signal systems, control system and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
 3. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.
 4. Quantities of materials will not be verified by the Architect or Engineer. Review stamp on shop drawings does not constitute review of quantities listed on shop drawings.
 5. Shop drawings:
 - a. All shop drawings shall be checked and signed by this contractor and general contractor prior to submittal to the Architect/Engineer. Equipment, materials, etc., not meeting specifications and/or drawing requirements shall be returned to the supplier for corrections before they are submitted to the Architect-Engineer. This Contractor is reminded that only those materials specified, approved or otherwise indicated by the project specifications, drawings, or addenda will be permitted to be used in constructing the electrical work for this project. The first review of submittals (shop drawings) will be provided as indicated at no charge to the Contractor. However, subsequent review(s) of resubmittals required by "Rejected" status from the original review will necessitate the Electrical Contractor being charged by the electrical consultant a fee of \$65 per man-hour, with a minimum charge of \$100 for each item resubmitted. It is intended that all electrical submittals be made in a complete and timely fashion such as to permit a comprehensive and thorough review of same.
 - b. Shop drawings submitted without Contractor's signatures or approval and verification will not be approved.
 - c. Shop drawings shall be submitted on wire, cables, devices, lighting fixtures (including distribution curves), motor starters, panelboards, disconnects, substations, transformers, switchgear, switchboards, motor control centers, conduit, raceway systems, all systems, etc.
 6. Each sheet shall be either 8 1/2" x 11"; 8 1/2" x 13"; or 11" x 17" bond with a 5" x 3" clear area for engineer's stamp. (This area shall not be used by this contractor or the general contractor's stamp.) Larger drawings shall be able to be blue printed.

7. Submittals for all systems (fire alarm, security, PA, controls, sound, clock, nurses call, intercom, etc.) shall include complete riser diagrams showing all conductors and conduit sizes.
 - E. Engineer's acceptance of Compliance Submittals will not relieve the Contractor from his responsibility for any deviations from the requirements of the contract documents, unless Contractor has in writing called Engineer's attention to such deviation at the time of submission and the Engineer has given written approval to the specific deviation; nor shall any acceptance by Engineer relieve Contractor from responsibility for errors or omissions in Compliance Submittals.
 - F. Quantity of Submittals: See the general specification sections.
- 1.15 ELECTRICAL WORK COMPLETION:
- A. Before requesting final inspection the following work must be completed.
 - B. Operating Instructions:
 1. The Contractor shall submit along with the shop drawings of the equipment, four (4) copies of operating instructions for all items. Instructions shall be prepared by the manufacturer of the equipment.
 2. After the operating instructions have been approved by the Engineer, the Contractor shall include the four (4) copies in maintenance instructions brochures.
 3. The Contractor shall also obtain all manufacturer's instructions, manuals, and one complete set of drawings and turn these over to the Architect at the completion of the project.
 4. The Contractor shall keep in a safe place, all keys and special wrenches furnished with equipment under this contract and shall give same to the Architect at the completion of the project.
 5. The Contractor shall prepare four (4) complete brochures covering all systems and equipment furnished and installed under his contract. Brochures shall be submitted to the Architect-Engineer for approval and delivery to the Owner. The Engineer will retain one copy. The cost of this brochure shall be included in the contract cost. Brochures shall contain the following:
 - a. Certified equipment drawings and/or catalog data clearly marked for equipment furnished as required for approval submission under detailed section of the specifications.
 - b. Complete operating and maintenance instructions for each item of equipment.
 - c. Complete part list for each equipment item.
 - d. Any special emergency operating instructions or a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to the various parts of the system.
 - e. Reviewed shop drawings with reviewed stamp of Engineer.
 - f. System test reports.
 6. Brochures shall be bound in hard backed three ring binders with an index, sub-dividers and reinforced sheets.

- a. Project name, and address, and date of submittal.
 - b. Section of work covered by brochure, i.e., "Electrical Work".
 - c. Name and address of Architect.
 - d. Name and address of Engineer.
 - e. Name and address of Contractor.
 - f. Telephone number of Contractor, including night or emergency number.
7. In addition to these written instructions, each respective Contractor shall fully and carefully instruct the Owner, or Owner's selected representatives, as to the proper operation, care and maintenance of each system and its equipment.
8. Fire Alarm, Security, Sound, PA, Clock, etc., Systems: The manufacturer shall conduct and record a device by device test. Verify completely proper operation. Record all items checked for each device and device location on a form. Submit this final checkout form to the Engineer.

1.16 TESTING AND ADJUSTMENT:

- A. All equipment shall be checked for proper adjustment and balance. All panelboards, distribution panels, switchboards, and transformers shall be balanced to provide a balanced load on each phase. A complete record of all such adjustments shall be made. Final readings shall be submitted to the Architect-Engineer for records. The Contractor shall provide all equipment, instruments, gauges, meters, etc., as required for the complete checking of these systems.
- B. Mechanisms of all electrical equipment shall be checked, adjusted, and tested for proper operation. Adjustable parts of all lighting fixtures and other electrical equipment shall be checked, adjusted, and tested as required to produce the intended performance.
- C. Completed wiring system shall be free from open or shorted circuits. After completion, this Contractor shall perform tests for insulation resistance in accordance with the requirements of the National Electrical Code.
- D. The Contractor shall maintain service and equipment for the testing of electrical equipment and apparatus until all work is approved and accepted by the Owner. A first class voltmeter and ammeter shall be kept available at all times and this Contractor shall provide service for test readings when and as required. All test readings shall be recorded on an approved form and submitted to the Architect.
- E. Before final acceptance is made, this Contractor shall, at his own expense, frame under plastic the sequence of operations of the sound system, controls, fire alarm, etc., for each and every item requiring instructions. These instructions shall be mounted as directed. He shall cover same with Engineer and/or his selected parties, and shall adjust all apparatus and place same in satisfactory operating service as approved by the Engineer.
- F. Final observation will be made upon written request from the Contractor after the project is complete. At the time of final observation, the Contractor shall be present or shall be represented by a person of authority. The Contractor shall demonstrate, as directed by the Architect-Engineer, that his work fully complies with the purpose and intent of the drawings and specifications. All labor, services, and all instruments or tools necessary for such demonstration and tests shall be provided by the Contractor.

1.17 AS-BUILT DRAWINGS:

- A. E.C. shall prepare and submit to the Engineer, upon completion of the project, one complete set of reproducible "As Built" drawings for the electrical portion of the project.

- B. Drawings shall clearly indicate any and all approved deviations (i.e. addendum items, change order data, etc.) from the Project Bid Documents.
- C. These drawings will become the property of the Owner and will be for his future reference file, record document.

1.18 FINAL OBSERVATION:

- A. Final observation will be made upon written request from the General contractor after the project is completed; in accordance with the Supplementary General Conditions.
- B. Furnish a workman familiar with this project to accompany the Engineer on final observation and have available ladders, drop cords, and other equipment as required to gain access to any portion of this system.
- C. This Contractor and his principal subcontractors shall be represented at the inspection by a person of authority responsible to demonstrate to the engineer that his work conforms to the intent of the plans and specifications.
- D. Extra observations made necessary by the Electrical Contractor's failure to comply with the conditions as set forth above shall be charged to the Contractor for the Inspector's time both on the job and spent in travel between the office and the project site.

1.19 GUARANTEE:

- A. This Contractor, by the acceptance of this specification and the signing of his contract, acknowledges his acquaintance with the requirements and guarantees that every part used in constructing the system as herein described will be of the best of its respective kind that can be obtained and will be erected in a most thorough and substantial manner by none but experienced workmen.
- B. He guarantees that all conduit as provided within and by this specification will be free from all obstructions of every description and will be free from holes or broken places and be well bonded together. He guarantees that all wiring and conduit to be used in construction of this project will be new and unused.
- C. He further guarantees to hold himself responsible for any defects which may develop in any part of the entire system, including apparatus and appliances provided under this section of the specification, and to replace and make good without cost to the Owner any such faulty parts of construction which develop defects at any time within one year from date of final certification of completion and acceptance. Provide manufacturer's engineering and technical staff at site to analyze and rectify problems that develop during guarantee period immediately. If problems cannot be rectified immediately to the Owner's satisfaction, advise Architect in writing, describe efforts to rectify situation, and provide analysis of cause of problem. Architect will then suggest course of action. The Electrical Contractor shall replace material and equipment that requires excessive service during guarantee period as defined and as directed by the Architect. This guarantee does not include ordinary lamp failure.
- D. Use of systems provided under the Specification for temporary services and facilities shall not constitute Final Acceptance of the work nor beneficial use by the Owner, and shall not institute guarantee period.

1.20 SINGULAR NUMBER:

- A. Where any device or part of equipment is referred to in these specifications or on the drawings in the singular number (such as "the switch"), such reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.21 PERFORMANCE:

- A. Provide as part of the work of this contract, in addition to the first year guarantee on equipment and materials, the following described routine maintenance and inspection. (The one year time period will not start until each and every item is complete in accordance with drawings and specifications and accepted by the Owner). Check all emergency systems, control, fire alarm, transformers, etc., correct and adjust same. This service to be provided during the guarantee period.

1.22 SYSTEM:

- A. System: Distribution characteristics shall be as indicated on drawings.

1.23 SUPPLEMENTARY CONDITIONS:

- A. Supplementary to all other terms of the contract, this work shall be performed subject to the following conditions.
- B. Materials and equipment installed on this project shall be first class in quality and shall be new and unused.
- C. Workmanship on this project shall be first class work performed by the experienced licensed mechanics of the proper trade.
- D. Work under this contract shall be adequately protected at all times. Storage, parking, signs, advertisement, fires and smoking shall conform to all applicable regulations and/or directions of the Architect.
- E. Measurements on job and shop layouts required for installation of work shall be the responsibility of the contractor and acceptance of work is subject to approval of shop drawings by the Architect.
- F. Contractor shall furnish all hoists, scaffolds, staging, runways and equipment necessary for the completion of this work.
- G. Obtain and pay for all required electrical permits and licenses.
- H. Maintain lights and guards required for safety.
- I. Remove temporary service after use.

1.24 CONTRACT CHANGES:

- A. All changes or deviations from the contract, including those for extra or additional work, must be submitted in writing for the approval of the Architect/Engineer. No verbal orders will be recognized.

1.25 RUBBISH/CLEANUP:

- A. All rubbish resulting from the work herein specified shall be periodically removed by this Contractor.
- B. Clean all electrical equipment and materials of all foreign matter (both inside and out). Clean all light fixtures using only methods and materials as recommended by the manufacturer.

1.26 PROPOSALS:

- A. The Contractor shall consult the General Conditions and the Proposal Form for proposals and subdivisions of the work required.

1.27 EXTENT OF WORK:

- A. The extent of the work under this heading of the contract shall be the furnishing of all plant, labor, materials, and equipment as required to complete work as shown on the drawings and as specified under this heading, and all plant, labor, materials and equipment not shown on the drawings or specified, but necessary to make installation complete in accordance with the intent of the contract, to provide first class, complete, and operative installation throughout.

1.28 TAXES:

- A. Contractor shall include all applicable local, state and federal taxes in his bid. Consult the Supplementary Conditions of these specifications relative to any and all tax exemptions permitted for this project.

END OF SECTION 26 05 00

SECTION 26 05 13 - WIRES AND CABLES, LOW VOLTAGE

PART 1- GENERAL

1.1 DESCRIPTION:

- A. This section includes the furnishing, installation, and connection of the power, lighting, system, and control wiring.

PART 2 - PRODUCTS

2.1 CABLE AND WIRE (POWER AND LIGHTING):

- A. Cable and Wire: Fed. Spec. J-C-30, except as hereinafter specified. All conductors shown on plans are sized for copper. UL label required. American, Southwire, Essex, or equal, rated 600 volts, finished with fadeless color coding and bearing Underwriters label.

All cable and wiring shall be continuous between electrical equipment. Splices shall not be added except as required for taps in branch circuits or as approved by the engineer. No splices will be allowed within panelboards and switchboards.

- B. Single Conductor:

1. Soft annealed copper.
2. All conductors #8 gauge and larger shall be stranded unless noted otherwise. All conductors #10 gauge and smaller may be solid or stranded unless noted otherwise on the drawings. Stranded conductors may be used only on devices and lugs that are U.L. listed for use with stranded conductors.
3. Minimum size No. 12, except where larger sizes are shown. (Size No. 14 minimum for controls).

- C. Insulation:

1. Wires for general use within the building shall be type THHN or type THWN, 90 degree rated except where called for otherwise on the drawings. Type THHN or type THWN shall be used at the temperature rating of equipment termination lugs, environmental conditions, and as Code allows. Wires for other than general use shall be as hereinafter specified for specific services.

- D. An equipment grounding conductor, sized per NEC Article "Grounding", shall be installed in each conduit containing phase conductors.

- E. Color Code:

1. All conductors shall be identified by circuit number and color coding at all termination points and splices. All conductors shall be identified in all pull and junction boxes by the following method of color coding. Means of identification shall be permanently posted at each branch circuit panel with a nameplate identifying color coding system used in that panelboard.

Phase	208/120V	480/277V	240V.	240/120V
A	Black	Brown	Black	Black

B	Red	Orange	Red	Red
C	Blue	Yellow	Blue**	
Neutral	White	Gray*		White
Ground	Green	Green	Green	Green
Iso. Grd	Green w/Yellow	Green w/Yellow	Green w/Yellow	Green w/Yellow

* or white with colored (other than green) tracer.

**Identify 'High Leg' per N.E.C.

2. Use solid color compound or solid color coating for No. 6 and smaller branch circuit conductors and neutral sizes.
 3. Phase conductors No. 4 and larger color code using one of the following:
 - a. Solid color compound or solid color coating.
 - b. Colored as specified using 3/4-inch wide tape. Apply tape in two layers, half overlapping turns for a minimum of three-inches for terminal points, and in junction boxes, pull boxes, troughs, manholes, and handholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable stating size and insulation type. Where any conductor is or can be supplied from an emergency system, the Contractor shall mark each conductor with an additional two layers, one-half lapped, of purple colored vinyl electrical tape.
 - c. Yellow stripe on isolated ground may be 1/4-inch wide yellow tape on top of green.
 4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
 5. Provide plastic engraved color code legend on each panelboard and switchboard per NEC Article "Branch Circuits", "Identification Of Ungrounded Conductors".
 6. All improperly color coded conductors will be completely replaced at no additional cost to Owner.
- F. See riser diagrams and/or other sections of the Specifications for types and ratings for sound, fire alarm, control and other special cables.
 - G. Where quantities of conductors in a raceway system are not specifically indicated, provide the number as required to maintain function, control and number of circuits as indicated.
 - H. All isolated ground circuits shall be provided with separate phase, neutral, and ground conductors (no shared neutrals or grounds). All isolated ground circuits shall be installed in separate raceways from all other circuiting.
 - I. Where multiple sets of conductors are indicated, do not install the same phase conductors in the same raceway. Each raceway shall be provided with A, B, C phase conductors, neutral (if indicated), and ground (if indicated).
 - J. Where GFCI circuit breakers are used, provide a separate neutral conductor for the GFCI circuit. (Not a shared neutral with another circuit).

2.2 SPLICES AND JOINTS:

- A. In accordance with UL 486 A, B, D and NEC.
- B. Splices and taps for #6 and larger conductors shall be made with block type terminations (with insulating jacket) or with split bolt connectors, covered and completely insulated with a minimum of three half-lapped layers of Scotch No. 33+ (105 degree C) plastic electrical tape or by approved insulated fastener. All splices and taps having irregular surfaces shall be properly padded with Scotchfil putty before application of insulating plastic tape. Scotchlok electrical pre-insulated spring pressure connectors or equal may be used for up to #8 conductors.

2.3 CONTROL WIRING:

- A. All control wiring shall be copper, solid or stranded, #14 Ga. or larger depending upon current requirements, with insulation type for 90 C. rating. Where stranded conductors are used, provide with spade type insulated copper terminals. Unless noted otherwise on the Mechanical drawings or herein, all mechanical control wiring for all systems shall be routed within conduit, shall be of the same insulation type and shall be continuous between outlets and boxes (with no splices or taps into conduit). All line and low voltage mechanical control wiring, conduit, connections, and/or terminations are by the Electrical Contractor unless specifically noted otherwise within the bidding documents.

2.4 WIRE LUBRICATING COMPOUND:

- A. The cable pulling lubricant shall be compatible with all cable jackets. The lubricant shall be UL (or CSA) listed. The lubricant shall contain no waxes, greases, silicones, or polyalkylene glycol oils or waxes.
- B. A 200-gram sample of the lubricant, when placed in a one-foot, split metal conduit and fully dried for 24 hours at 105 degrees C, shall not spread a flame more than three-inches beyond a point of ignition at a continued heat flux of 40 kW/m². Total time of test shall be one-half hour.
- C. Approved Lubricant is:
 - Dyna Blue
 - Polywater J available from:
 - American Polywater Corporation
 - Equal by Quick Slip from Buchanan
 - CCR Wire Pulling Lube from CRC
 - Poly-X from American Colloid.

2.5 FIREPROOFING TAPE:

- A. The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame-retardant elastomer.
- B. The tape shall be self-extinguishing and shall not support combustion. It shall be arcproof and fireproof.
- C. The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.

- D. The finished application shall withstand a 200 ampere arc for not less than 30 seconds.
- E. Securing tape: Glass cloth electrical tape not less than 7 mils thick, and 3/4-inch wide.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERALLY:

- A. Install in accordance with the NEC, and as specified.
- B. Unless noted otherwise on the Electrical drawings or herein, all wiring for all systems shall be routed within conduit, shall be of the same insulation type and shall be continuous between outlets and boxes (with no splices or taps into conduit).
- C. Splices and taps in outlet boxes shall be twisted joints. U.L. approved pre-insulated spring pressure connectors shall be used for branch circuit connections. Connectors shall be installed so that all conductors are properly insulated.
- D. Splice cables and wires only in outlet boxes, junction boxes, pull boxes, manholes, or handholes. Do not splice cables in panelboards, switchboards, disconnects, etc.
- E. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.
- F. For panelboards, cabinets, wireways, switches, and equipment assemblies, neatly form, and tie all cables.
- G. Seal cable and wire entering a building from underground between the wire and conduit, where the cable exits the conduit, with a non-hardening approved compound.
- H. Wire Pulling:
 - 1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
 - 2. Use ropes made of nonmetallic material for pulling feeders.
 - 3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the Engineer.
 - 4. Pull multiple cables into a single conduit with a single continuous pull.
 - 5. Always use wire lubricant per this specification.

3.2 SPLICE INSTALLATION:

- A. Splices and terminations shall be mechanically and electrically secure.
- B. Where the Engineer determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Owner.

3.3 CONTROL, COMMUNICATION, AND SIGNAL WIRING INSTALLATION:

- A. Unless otherwise specified in other sections of these specifications, install wiring as described below. Wiring shall be connected to perform the functions shown and specified in other sections of this specification.
- B. Except where otherwise required, install a separate power supply circuit for each system, or control equipment, or control power. Circuit to nearest 120 volt panel or nearest emergency panel if equipment controlled is connected to emergency system. Provide 20 Amp breakers in panels where none are designated. Verify all requirements with actual equipment supplied in field.
- C. Install a breaker lock-on clip on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.
- D. System voltages shall not exceed 120 volts and shall be lower voltages where shown on the drawings or required by the NEC.
- E. Wire and cable identification:
 - 1. Install a permanent wire marker on each wire at each termination, outlet box, junction box, panel, and device.
 - 2. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.
 - 3. Wire markers shall retain their markings after cleaning.

3.4 FIELD TESTING:

- A. Feeders and branch circuits shall have their insulation tested after installation and before connection to utilization devices such as fixtures, motors, or appliances.
- B. Test shall be performed by meggar and conductors shall test free from short-circuits and grounds.
- C. Test conductors phase-to-phase and phase-to-ground.
- D. Meggar motors after installation but before start-up and test free from grounds.
- E. The Contractor shall furnish the instruments, materials, and labor for these tests.

END OF SECTION 26 05 13

SECTION 26 05 26 - GROUNDING

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies general grounding and bonding requirements of electrical installations.

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS:

- A. General Purpose: UL and NEC approved types, copper, with THHN or type THWN, or dual rated THHN-THWN insulation color identified green, 90 degree rated.
- B. Size conductors not less than what is shown and not less than required by the NEC.

2.2 GROUND RODS:

- A. Copper clad steel, 3/4-inch diameter by 10 feet long.

2.3 SPLICES:

- A. All splices and grounding electrode connections shall be made with exothermic welds.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERALLY:

- A. Ground in accordance with the NEC as shown, and as hereinafter specified. All equipment ground conductors shall be terminated on a ground bus or ground lug attached to equipment can.
- B. System Grounding:
 - 1. Secondary service neutrals shall be grounded at the supply side of the secondary disconnecting means and at the related transformers.
 - 2. Separately derived systems (transformers downstream from the service entrance) ground the secondary neutral.
 - 3. Individual Buildings: Bond Main Disconnect ground bus to water pipe, and driven ground. Provide bond to 20 foot re-bar in foundation or to building steel, if indicated on the drawings or required by local Codes.
- C. Equipment Grounding:
 - 1. Metallic structures, enclosures, raceways, junction boxes, outset boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be grounded for personnel safety and to provide a low impedance path for possible ground fault currents.

3.2 SECONDARY EQUIPMENT AND CIRCUITS:

- A. Main Bonding Jumper: Connect the secondary service neutral to the ground bus in the service equipment.
- B. Water Pipe and Supplemental Electrode:
 - 1. Provide a ground conductor connection between the service equipment ground bus and the metallic water pipe system. Jumper insulating joints in the water pipe.
 - 2. Provide a supplemental grounding electrode and bond to the water pipe ground, or connect to the service equipment ground bar.
- C. Service Disconnect: Provide a ground bar bolted to the enclosure with lugs for connecting the various grounding conductors. Connect the neutral to the ground bus (main bonding jumper).
- D. Switchgear, Switchboards:
 - 1. Connect the various feeder green grounding conductors to the ground bus in the enclosure with suitable pressure connectors.
 - 2. Connect the grounding electrode conductor to the ground bus.
 - 3. Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and ground conductor to the ground bus.
- E. Transformers:
 - 1. Exterior: Exterior transformers supplying interior service equipment shall also have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.
 - 2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to the nearest cold water pipe.
- F. Raceway Systems:
 - 1. Ground all metallic raceway systems.
 - 2. Raceway provided for mechanical protection containing only a grounding conductor, bond to that conductor at the entrance and exit from the raceway.
- G. Feeders and Branch Circuits: Install green grounding conductors with feeders and branch circuits in all feeders and branch circuits and in any raceway containing a phase conductor.
- H. Isolated Grounds: All isolated grounds must be insulated and must terminate on isolated ground buses in the equipment. No other equipment grounds shall be connected to isolated ground bus. Where isolated grounds are shown and PVC conduit is used, an equipment ground must be installed to ground metallic boxes and mounting straps. Provide separate isolated ground for each circuit. (No shared ground conductors for isolated circuits).

- I. Boxes, Cabinets, Enclosures, and Panelboards:
 - 1. Bond the grounding conductors to each pullbox, junction box, outlet box, cabinets, and other enclosures through which the ground conductors pass (except for special grounding systems for intensive care units and other critical units shown.).
 - 2. Make ground conductor connections to ground bus in motor control centers, panelboards, etc.
- J. Receptacles and toggle switches are not approved for grounding through their mounting screws. Ground devices from the grounding conductor of the wiring system to the green ground terminal on the device.
- K. Ground lighting fixtures to the green grounding conductor of the wiring system.
- L. Fixed electrical appliances and equipment shall have a ground lug installed for termination of the green ground conductor.
- M. Telephone Terminal Boards: Provide a #6 cu. ground in 3/4" c. from each board to the main service disconnect ground bus.

3.3 CONDUCTIVE PIPING:

- A. Bond all conductive piping systems in the building to the electrical system ground. Bonding connections shall be made as close as practical to the water pipe ground or service equipment ground bus.

3.4 GROUNDING RESISTANCE:

- A. Grounding system ground resistance must not exceed 5 ohms. Final tests shall assure that this requirement is met. Submit to the Engineer.
- B. Where permanent ground connections are required, make the connections by the exothermic process to form solid metal joints.
- C. Where rock prevents the driving of vertical ground rods, install grounding electrodes in horizontal trenches to achieve the specified resistance.
- D. Where more than one ground rod is required to meet the specified resistance, they shall be located at least 10 feet apart.

END OF SECTION 26 05 26

SECTION 26 05 30 - RACEWAY SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section includes the furnishing, installation, and connection of raceways, fittings, and boxes to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.
- B. Definitions: The terms 'conduit' or 'raceway', as used in this specification or on the drawings, shall mean any or all of the raceway types specified. The term 'surface metal raceway', as used in this specification or on the drawings, shall refer to raceway types specified in 2.1-K.

PART 2 - PRODUCTS

2.1 MATERIAL:

- A. Raceway Size: In accordance with the NEC but not less than 1/2-inch unless otherwise noted in other sections of the Specifications.
- B. Raceways: Install raceway types as shown on drawings and as listed below. No other raceway systems other than listed below will be allowed. All conduit sizes listed on the drawings are based on conductor fill in EMT conduit. If other conduit types are used, adjust conduit sizes to conform with NEC Chapter 9, Table 4.
 - 1. Rigid steel: UL 6. Rigid intermediate steel conduit (IMC): UL 1242. Rigid conduit (GRC) and intermediate metal conduits (IMC) shall be standard size, hot dip galvanized steel conduit, minimum 1/2" trade size, as manufactured by Triangle PWC, Inc., Allied, or equal. Rigid conduit and IMC shall be provided with threaded fittings and couplings. In trade sizes 2-1/2" to 4", contractor may use Allied 'KwikCouple' fittings in lieu of individual steel couplings. Where 'Kwik-Couple' fittings are used exterior for vertical risers, install fitting with taper end up. A "green" ground wire, sized per NEC 250-122, shall be installed in all conduits containing phase conductors. All conduit exposed exterior of building, in wet locations or subject to physical abuse shall be Rigid Steel or IMC.
 - 2. Electrical Metallic Tubing (EMT): U.L. 797. EMT (thinwall conduit) shall be minimum 1/2" trade size, as manufactured by Triangle PWC, Inc., Allied, or equal. Provide EMT with Thomas and Betts, or equal, U.L. listed steel or die-cast type fittings. Indenter type fittings shall not be used. Contractor may use Allied 'Kwik-Fit' fittings in lieu of individual fittings. A "green" ground wire, sized per NEC 250-122, shall be installed in all conduits containing phase conductors. EMT conduit shall not be installed in earth, in wet locations, exposed exterior to the building, subject to physical abuse, or below grade.
 - 3. Flexible steel conduit: Fed. Spec. WW-C-566 and UL 1. Short runs (6' or less) of galvanized steel or liquid tight steel flexible conduit (flexible steel tubing covered with extruded liquid-tight jacket of polyvinyl chloride) may be used when approved by the Engineer. (Minimum 1/2" trade size.) A separate "green" ground conductor (sized per N.E.C.) shall be installed in all flexible conduits. Type AC "Armored Cable", Type MC "Metal-clad Cable", or "BX" cable shall not be used in any manor unless supplied as part of a manufactured flexible wiring system for lighting and approved by the Engineer in writing.

4. U.L. approved schedule 40 P.V.C. conduit may only be used where conduits are to be run in earth or below slabs. PVC conduits shall not be used in patient care areas (other than patient sleeping areas) above or below grade. (NEC Article 517.13 (A), 517.10 (B) (2)). These locations shall have branch circuit wiring installed in a metal raceway system, or a cable having a metallic armor or sheath assembly. P.V.C. conduits shall not be used above grade inside or outside of the building, unless specifically noted otherwise on the drawings. Use G.R.S. ells and risers, both horizontal and vertical, unless specifically noted otherwise on the drawings. Use conduit adapters when converting from P.V.C. to steel conduit. Branch circuit and feeder P.V.C. conduit to be 3/4" min. Concrete encase all conduit installed below grade where so noted on the drawings, (U.L. approved schedule 40 P.V.C. with plastic spacers). All P.V.C. conduit shall be provided with a separate "green" ground conductor, sized per N.E.C.

C. Conduit Fittings:

1. Rigid steel and IMC conduit fittings:
 - a. Standard threaded couplings, locknuts, bushings, and elbows: Fed. Spec. W-F-408, except only material of steel or malleable iron are acceptable. Integral retractable type IMC couplings are acceptable also.
 - b. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
 - c. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted. Bushings for conduit smaller than 1-1/4-inch shall have flared bottom with ribbed sides.
 - d. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
 - e. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
 - f. In trade sizes 2-1/2 inches to 4-inches for rigid steel raceway or intermediate metal raceway, contractor may use Allied 'Kwik-Couple' fittings in lieu of individual steel couplings. 'Kwik-Couple' fittings shall not be used in hazardous locations. Where 'Kwik-Couple' fittings are used exterior for vertical risers, install fitting with taper end up.
 - g. Where conduits enter boxes, they shall be rigidly clamped to the box by double locknuts and bushings. Conduit shall enter the box squarely. Bushings and locknuts shall be made of malleable iron and shall have sharp clean-cut threads.

2. Electrical metallic tubing fittings:
 - a. Fed. Spec. W-F-408, except only material of steel for compression type. Steel or die-cast is acceptable for set screw type. Die-cast compression is not acceptable.
 - b. Couplings and connectors: Suitable for the installation. Use gland and ring compression type or set screw type couplings and connectors. Use concrete tight where installed in concrete. Set screw type couplings for conduit 2 inches and larger shall have four set screws each. Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
 - c. Indenter type connectors or couplings are prohibited.
 3. Flexible steel conduit fittings:
 - a. Fed. Spec. W-F-406 and UL 5, except only steel or malleable iron material is acceptable.
 - b. Clamp type, with insulated throat.
 4. Liquid-tight flexible metal conduit fittings:
 - a. Fed. Spec. W-F-406, except only steel or malleable iron material is acceptable.
 - b. Type incorporating a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
 5. Expansion and deflection couplings:
 - a. UL 467 and UL 514.
 - b. Accommodate, 1.9 cm (0.75") deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
 - c. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.
 - d. Shall be watertight, seismically qualified, corrosion-resistant, threaded for and compatible with rigid or intermediate metal conduit.
 - e. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.
- D. Raceway Supports:
1. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
 2. Pipe Straps: Fed. Spec. FF-S-760, Type I, Style A or B.
 3. Individual Raceway Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.

4. Multiple Raceway (trapeze) hangers: Not less than 1-1/2 by 1-1/2 inch, 12 gauge steel, cold formed, lipped channels; with not less than 3/8-inch diameter steel hanger rods.
 5. Solid Masonry and Concrete Anchors: Fed. Spec. FF-S-325; Group III self-drilling expansion shields, or machine bolt expansion anchors Group II, Type 2 or 4, or Group VIII.
- E. Outlet Boxes:
1. UL-50, UL514A, Fed. Spec. W-C-586 and Fed. Spec. W-J-800.
 2. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.
 3. Sheet metal boxes: 4-inch square, galvanized steel, except where otherwise shown. Single gang 'Handy Boxes' will not be allowed.
 4. Boxes installed in concrete or masonry and boxes larger than two gang shall be masonry type.
- F. Wireways: Equip with hinged covers, except where removable covers are shown. All exterior wireways NEMA 3R. Size all wireways per National Electrical Code.
- G. Pull and Junction Boxes:
1. Pull and junction boxes shall be code gauge steel boxes with hinged, bolted or screwed covers. Boxes shall be flush or surface mounted as shown or required by N.E.C and job conditions.
 2. Junction and pull box shall be installed where shown on drawings and additional boxes shall be installed if required for pulling of wire provided location and installation is approved by the Architect. All boxes shall be code construction and size with screw type cover and shall be installed in accessible locations.
 3. Conductors shall not be spliced within pull boxes.
 4. Boxes shall be rated as shown on the drawings or as required by applicable codes, ie: raintight, weatherproof, explosionproof, etc.
- H. Floor Boxes:
1. Verify exact location of all floor boxes with the architect prior to rough-in. All floor boxes shall conform to UL 514A and UL 514C scrub-water testing standards. Unless otherwise specified on the drawings or in the special outlet schedule, floor boxes shall be as follows, or equal by Walker/Wiremold:
 - a. Fully adjustable, stamped steel, concrete tight with knockouts on bottom and all four sides (1/2", 3/4" and 1" sizes) shall be Steel City #68-D or Hubbell #B-2527 deep when concrete floor thickness above any part of deck is 4-inch thick or more; and Steel City #68-S or Hubbell #2529 shallow when concrete floor thickness is 3-inch up to 4-inch.
 - b. Cover plates shall be polished brass. Steel City #P60-DS or Hubbell #S3925 hinged lift L105 for duplex receptacles, Steel City #P60 or

Hubbell #S Series for single receptacles with removable plug sized to match the receptacle to be installed, and Steel City #P60-3/4-2 or Hubbell #S-88-1 for telephone, TV, microphone, and furniture feed floor boxes. Route liquidtight conduit from furniture feed floor box to furniture.

- c. Provide polished brass carpet flanges in all carpeted areas: Steel City #P60-CP or Hubbell #S-3082.
 - d. PVC floor boxes may be used in lieu of floor boxes indicated above. PVC floor boxes shall be equal to Walker, Wiremold, Hubbell, Carlon, with metal covers. Receptacle covers shall be double flap, telephone and data covers shall be combination 2"1/2" inserts. Unless noted otherwise on the drawings, all floor boxes for similar devices shall be either metal or PVC, no intermixing of same types of floor boxes will be allowed.
2. Multi-gang floor boxes shall be fully adjustable, cast iron, watertight use deep type in floors 4-inch or thicker and use shallow type in floors 2 1/2-inch to 4-inch thick. All multi-gang floor boxes shall conform to UL 514A and UL 514C scrub-water testing standards. Provide barriers between line and low voltage compartments of multi-gang floor boxes.

Multi-gang floor boxes: (or equal by Walker/Wiremold)

STEEL CITY	Single	Double	Triple
Deep Floor Box	641	642	643
Shallow Floor Box	841	842	843
Carpet Flange	P64-CP	P64-2G-CP	P64-3G-CP
HUBBELL	Single	Double	Triple
Deep Floor Box	B-2436	B-4233	B-4333
Shallow Floor Box	B-2414	B-4214	B-4314
Carpet Flange	SB-3083	SB-3084	SB-3085

Cover plates shall be polished brass Steel City #P64-DS or Hubbell #S3825 for duplex receptacles, Steel City #P64 or Hubbell #S Series for single receptacles with removable plug sized to match the receptacle to be installed; and Steel City #P64-3/4-2 or Hubbell S-2425 for telephone, TV, microphone, and other systems floor boxes.

- I. Poke Through Outlets: Verify exact location with Architect prior to rough in. Poke through outlets shall be UL Listed for 2 hour fire rating. All poke-through outlets shall conform to UL 514A and UL 514C scrub-water testing standards.
 1. Flush Type: Provide with 20A., 120 volt duplex receptacle or 20A. 120 volt duplex isolated ground receptacle as shown on the drawings, per the specification. Walker RC3A20BS Series, or equal by Hubbell. Verify flange and slide color with Architect.
 2. Flush furniture feed: Walker RC7006ABR Series, or equal by Hubbell, with liquidtight conduit connection to furniture. Verify flange and conduit adaptor assembly color with Architect.

- J. Concealed Service Floor Box: Verify exact location with architect prior to rough-in. All concealed service floor boxes shall conform to UL 514A and UL 514C scrub-water testing standards.
1. Multiple service type with no exposed service fittings. Provide with receptacle, telephone, and data outlets as shown in the Special Outlet Schedule. Verify color with the Architect. Unless otherwise noted in the Special Outlet Schedule, provide Walker RFB4 Series with receptacle, data, and telephone brackets as required and S36CCTC Series recessed activation cover, or equal by Hubbell or Steel City.
- K. Surface Metallic Raceway:
1. Only metallic surface raceways shall be used unless specifically noted otherwise on the Drawings.
 2. Surface metallic raceway and associated outlet boxes shall only be used where shown on the drawings and in remodels and modifications to existing where existing wall and ceiling voids do not permit concealed installation, but shall not be used at any other location unless shown otherwise on the drawings. All outlet box and surface metallic raceway locations must first be approved and coordinated with the Architect. All surface raceway and outlets must be painted to match the surface it is attached to. Use outlet boxes and fittings by the same manufacturer and approved for use with the raceway. Install an equipment grounding conductor sized per NEC Article "Grounding" for the largest circuit in the raceway if not already specified.
 3. Raceways shall be Wiremold #V500 minimum or #V700 for small sizes and Wiremold Series 2000, 3000, and 4000 for larger capacities, unless noted otherwise on the drawings. In all cases, do not exceed the fill per the manufacturers published data. Surface metallic raceways shall be sized to match the conduit sizes indicated on the drawings, or as required by Code. For telephone, data, video, or CATV outlet boxes, use Wiremold V700 series minimum.
 4. Surface metallic raceways shall be provided with all mounting hardware, covers, fittings, outlet boxes, elbows, tees, etc. as required for a complete system.

PART 3 - EXECUTION

3.1 RACEWAY:

- A. An equipment grounding conductor, sized per NEC Article "Grounding", shall be installed in all conduits containing phase conductor(s).
- B. Rigid galvanized steel (GRC) or IMC must be used at all times when exposed to weather or physical abuse and in all NEC classified hazardous locations. EMT may not be used in direct contact with earth, or in concrete slabs on grade.
- C. U.L. approved Schedule 40 P.V.C. conduit may be used where feeders or branch circuits are to be run in earth or slabs (3/4" minimum), except as noted otherwise in 2.1-B-4. Use GRC ells and riser, both horizontal and vertical. All conduit risers through concrete floors shall be GRC from below the top of the floor slab. Use conduit adapters when converting from P.V.C. to steel conduit. Use plastic spacers when more than one conduit is installed together. Spacers shall be installed per NEC Article "Rigid Nonmetallic Conduit". See

Drawings for areas requiring concrete encasement. All P.V.C. conduits shall be provided with separate ground conductor sized per N.E.C.

3.2 PENETRATIONS:

A. Cutting or Holes:

1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the Structural Engineer prior to drilling through structural sections.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Structural Engineer as required by limited working space.
3. All patching shall be done in a neat and workman-like manner, meeting with the approval of the Architect, by mechanics of the particular trade involved.

B. Fire Stop:

1. Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases, and maintains specified fire rating. Completely fill and seal clearances between raceways and openings with the fire stop material.

C. Fire Barrier Penetration Seals:

1. Manufacturer: Subject to compliance with requirements, provide fire barrier penetration seals of one of the following:
 - 3M fire Barrier Caulk, Putty, or Strip Sheet
 - Carborundum Fiberfrax Fyre Putty
 - Tremco X-ferno Fire Products
 - Rectorseal Metacalk
2. Provide seals for any opening through fire-rated walls, floors or ceilings used as passage for components such as conduits or cables.
3. Cracks, voids or holes up to 4-inch diameter: Use putty or caulking, one-piece intumescent elastomer, non-corrosive to metal, compatible with synthetic cable jackets, and capable of expanding 10 times when exposed to flame or heat and UL-listed.
4. Openings greater than 4-inch diameter and raceway sleeves through floors at telephone terminal boards: Use sealing system capable of passing 3-hour fire test in accordance with ASTM E-814, consisting of wall wrap or liner, partitions, and end caps capable of expanding when exposed to temperatures of 250 degrees to 350 degrees F (121 to 177°C), that is UL-listed. KBS "Sealbags" manufactured by P-W Industries will be acceptable.
5. Execution: Fill entire opening with sealing compound. Adhere to manufacturer's installation instructions. All fire barrier seals shall meet the rating of the wall.

D. Waterproofing:

1. At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight.
2. Any penetrations through roof shall be made with "Stoneman" flashing connections as manufactured by Stoneman Engineering and Manufacturing Co., Inglewood, California, and any penetrations made in exterior or basement foundation walls shall be sealed with Thunderline "Link-seal" connections, as manufactured by Thunderline Corporation, Wayne, Michigan.

3.3 CONDUIT SYSTEMS INSTALLATION, GENERAL:

A. Installation: In accordance with UL, NEC, as shown, and as hereinafter specified.

B. Install raceways as follows:

1. In complete runs before pulling in cables or wires.
2. Flattened, dented, or deformed raceways is not permitted. Remove and replace the damaged raceways with new undamaged material.
3. Assure raceway installation does not encroach into the ceiling height head room, walkways, or doorways.
4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.
5. Mechanically and electrically continuous.
6. Independently support raceway. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, mechanical piping, or mechanical ducts.). Group raceways with common supports where possible. Conduit shall be supported within 12-inches of connectors.
7. Close ends of empty raceway with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in, or at locations where conduits are stubbed out below grade outside of building.
8. Raceway installations under fume and vent hoods are prohibited.
9. Secure raceways to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For GRC and IMC raceway installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make raceway connections to junction box covers.
10. Raceways shall not be used as a support for other raceways or cables.
11. Where conduit sizes are not specifically indicated, provide sizes in accordance with the requirements of the N.E.C.
12. Conduit to be installed to the requirements of structure and to the requirements of all other work on the project. Conduit shall be installed to clear all openings, depressions, pipes, ducts, reinforcing steel, etc. Conduit set in forms for concrete structure shall be installed in such a manner that installation will not affect the strength of the structure. Coordinate installation with Structural Engineer for conduits rising up from floor slabs into bottom of panelboards. Minimum distance

between conduits shall be 6". Maximum size of conduit permitted in concrete slabs, if so approved by the Architect, is 1" trade size.

13. Conduit shall be installed continuous between connections to outlets, boxes and cabinets with a minimum possible number of bends and not more than the equivalent of 4-90 degree bends between J-box connections. Bends shall be smooth and even and shall be made without flattening conduit or flaking enamel. Radius of bends shall be as long as possible and never shorter than the corresponding trade elbow. Long radius elbows shall be used where necessary.
14. Conduits shall be securely fastened in place with approved straps, hangers, and steel supports as required by the National Electrical Code. All surface mounted conduits on walls below eight foot above grade shall be secured with conduit straps, no clamps. The use of wire, plumbers straps, etc, will not be permitted.
15. Junction and pull boxes shall be installed where shown on drawings and additional boxes shall be installed if required for pulling of wire, provided location and installation is approved by the Architect. All boxes shall be code gauge construction with screw type covers and shall be installed in accessible locations.
16. Conduit shall be reamed and thoroughly cleaned before installation and kept clean after installation. Openings shall be plugged and boxes shall be covered as required to keep conduit clean during construction. All conduit shall be fished clear of obstructions before the pulling of wires. All conduit shall be as sized above and shall not be smaller than N.E.C. listed minimum requirements.
17. All work shall be protected against damage during construction and any work damaged or moved out of line after roughing-in shall be repaired and reset to the approval of the Architect without additional cost to the Owner.
18. Conduit terminations at panelboards, switchboards, motor control equipment, junction boxes, etc., shall be aligned and installed true and plumb. Wood or steel bucks or templates shall be used where required. This work shall also include all steel supports as required for mounting of electrical equipment excepting only where steel supports are specified to be furnished under another specification heading.
19. Where conduits cross construction expansion joints, Contractor shall provide Appleton XJ or equal expansion couplings with copper bonding jumpers.
20. Where conduits are installed in concrete, all connectors and couplings shall be water tight or rated for direct burial in concrete.
21. Mechanical equipment service clearances and electrical apparatus service clearances as specified in their respective manufacturer's product data shall be maintained free from conduit obstructions.
22. Raceways shall not be routed through mechanical ductwork.
23. Route all surface metallic raceways for receptacle, telephone, data and all other wall outlet boxes horizontal at base of wall to nearest corner or door trim before rising vertically up wall. Locate all boxes for devices near doors as near as possible to door trim and rise surface metallic raceway up wall adjacent to door trim. Any surface metal raceways routed down walls into existing floors shall be installed tight to existing walls into the existing floor. If this can not be

accomplished because of existing conditions, the surface metal raceways shall be routed to or into the ceiling of the room.

C. Raceway Bends:

1. Make bends with standard raceway bending machines.
2. Raceway hickey may be used for slight offsets, and for straightening stubbed out raceways.
3. Bending of raceways with a pipe tee or vise is prohibited.

3.4 CONCEALED WORK INSTALLATION:

A. General:

1. Raceway and Outlet Boxes Installation: All raceway systems work and outlet boxes shall be installed concealed in walls, floor and roof construction or concealed within furred spaces or above ceilings. In equipment or mechanical rooms exposed work shall include feeders and connections to equipment unless noted otherwise.

B. In Concrete:

1. Raceway: GRC, IMC, EMT, or PVC; except do not install EMT in concrete slabs that are in contact with soil, gravel or vapor barriers.
2. Align and run raceways in direct lines (parallel and perpendicular).
3. Install raceways through concrete beams only when the following occurs:
 - a. Where shown on the structural drawings.
 - b. As approved by the Structural Engineer prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
4. Installation of raceways in concrete that is less than three inches thick is prohibited. All raceways installed in concrete shall be approved by the Structural Engineer.
 - a. Raceway outside diameter larger than one-third of the slab thickness is prohibited.
 - b. Space between raceways in slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.
 - c. Install raceways approximately in the center of the slab so that there will be a minimum of 3/4-inch of concrete around the raceways.
5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to insure low resistance ground continuity through the raceways. Tightening set screws with pliers is prohibited.

C. Above Furred or Suspended Ceilings and in Walls:

1. Raceways for conductors 600 volts and below:
 - a. GRC, IMC, or EMT. Types mixed indiscriminately in the same system is prohibited.
2. Raceways for conductors above 600 volts:
 - a. GRC.
3. Align and run raceways parallel or perpendicular to the building lines.
4. Connect recessed or lay-in lighting fixtures and all other devices installed in a lay-in ceiling to raceway runs with flexible metal conduit extending from a junction box to the fixture. Provide a ground wire in all flexible conduits.
5. Tightening set screws with pliers is prohibited.

3.5 EXPOSED WORK INSTALLATION:

- A. Exposed work only where permitted by the Architect.
- B. Raceways for Conductors 600 volts and below:
 1. GRC, IMC, or EMT types mixed indiscriminately in the system is prohibited.
 2. All raceways exposed to physical abuse and in all industrial pump and treatment plant locations shall be GRC or IMC.
- C. Raceways for conductors above 600 volts:
 1. GRC
- D. Align and run raceways parallel or perpendicular to the building lines.
- E. Install horizontal runs close to the ceiling or beams and secure with raceway straps.
- F. Surface metal raceways: Use only where approved and coordinated with Architect.
- G. Painting:
 1. Paint exposed raceways as specified in Section, PAINTING.

3.6 WET OR DAMP LOCATIONS:

- A. Unless otherwise shown, use raceways of GRC or IMC above grade. Use PVC conduit below grade, except rigid galvanized steel ells and risers shall be used.
- B. Provide sealing fittings, to prevent passage of water vapor, where raceways pass from warm to cold locations, i.e., (refrigerated spaces, constant temperature rooms, air conditioned spaces) or similar spaces.

3.7 MOTORS AND VIBRATING EQUIPMENT:

- A. Use liquid-tight Type UA flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission. Provide liquid-tight flexible metal conduit for installation in exterior

locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, and locations subject to seepage or dripping of oil, grease or water. Provide a green ground wire with flexible metal conduit.

3.8 RACEWAY SUPPORTS, INSTALLATION:

- A. All raceways shall have supports at maximum spacing of 10-feet and within 3-feet of a fitting, elbow, box outlet or enclosure. Safe working load shall not exceed 1/4 of proof test load of fastening devices. This shall apply to both vertical and horizontal conduit runs.
- B. Use pipe straps or individual raceway hangers for supporting individual conduits.
- C. Support multiple raceway runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the raceways, wires, hanger itself, and 200 pounds. Attach each raceway with U-bolts or other approved fasteners.
- D. Support raceways independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items. Do not support raceways from mechanical piping or ductwork.
- E. Fasteners and Supports in Solid Masonry and Concrete:
 - 1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
 - 2. Existing Construction:
 - a. Steel expansion anchors not less than 1/4-inch bolt size and not less than 1-1/8 inch embedment.
 - b. Power set fasteners not less than 1/4-inch diameter with depth of penetration not less than 3-inches.
 - c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
- F. Hollow Masonry: Toggle bolts are permitted. Bolts supported only by plaster are not acceptable.
- G. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- H. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- I. Chair, wire, or perforated strap shall not be used to support or fasten conduit.
- J. Spring steel type supports "caddy clips" that are listed for the intended use are acceptable in appropriate locations.
- K. Vertical Supports: Vertical raceway runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.10 BOX INSTALLATION:

- A. Boxes for Concealed Raceways:
1. All outlet boxes shall be flush mounted unless noted otherwise on the drawings or herein. Boxes installed in gyp board or plaster finish shall have code gauge galvanized raised covers set to not more than 1/4" behind final finish in non-combustible walls or ceilings, and flush with the wall or ceiling finish in combustible walls or ceilings. Covers shall be selected with proper openings for devices installed in box.
 2. Mount flush. Boxes protruding from the finished wall or ceiling surface; recessed with more than 1/4-inch gap between the wall or ceiling surface and the box in non-combustible walls or ceilings; or not flush with the wall or ceiling surface in combustible walls or ceilings will be changed out with all wall or ceiling reconstruction expense paid by the Electrical Contractor.
 3. Provide raised covers for boxes to suit the wall or ceiling construction and finish.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.
- C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
- D. Outlet boxes in the same wall mounted back-to-back are prohibited.
- E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 4-inches square by 2-1/8 inches deep, with device covers for the wall material and thickness involved.
- F. Where lighting fixtures and appliance outlets are to be mounted in concrete or in plaster finish on concrete, outlet boxes shall be installed in forms at exact dimensions from bench marks, columns, walls or floors.
- G. Where lighting fixtures and appliances outlets are to be mounted on masonry walls and/or plastered furring or other finish, outlet boxes shall be roughed in to general location before installation of wall and furring and shall be reset to exact dimensions before walls and furring are constructed.
- H. All outlet boxes shall be set true to horizontal and vertical lines parallel to walls, floors and ceilings and true to finish lines. All boxes shall be secured to ceilings or walls so all installations are solidly mounted.
- I. Boxes mounted to metal studs shall be mounted with Caddy #MSF metal stud clip, or equal as approved by the Engineer. Boxes mounted to either metal or wood studs shall be mounted with Caddy #7666 farside box support, or equal as approved by the Engineer. Single metal stud box clips without box supports are not acceptable for mounting boxes.
- J. Boxes for exterior or wet location exposed work (where approved by the engineer) shall be Appleton or Pyle National Type FS or FSC for shallow devices and Type FD or FDC for deep devices. Boxes for ceiling mounted light fixtures shall have approved no-bolt fixture studs. Boxes used as junction boxes shall have beveled edge flat steel blank cover.

- K. Where outlet boxes are mounted exposed in unfinished areas, (where approved by the engineer) surface mounted boxes shall be 4-inches square, have rounded corners and 1/2-inch raised steel cover plates.
- L. Location of outlets on small drawings is approximate and exact dimensions for locations of outlets shall be as taken from large scale plans and details on drawings or as directed by the Architect/Engineer. Outlets shall be located generally from column centers and finished wall lines or to center of wall or joints between wall panels. Ceiling outlets shall be installed at elevation of suspended ceiling connected to outlets in ceiling or slab above. Where necessary to fit and center with panel or ceilings and wall spaces, the contractor must, at no expense the Owner, shift the lighting outlets or other outlets as required by the Architect.
- M. Clock outlets shall be mounted 7-inches below ceiling height unless otherwise noted on the drawings. All other outlets shall be mounted at heights above floor as called for on drawings or as directed.
- N. Bracket lights over mirrors shall be centered on mirrors with 2-inch fixture clearance above mirror.
- O. Boxes for switches and receptacles installed in columns shall be located off center to allow for future partitions.
- P. Boxes for switches at or near door shall be installed on the side opposite the hinge. Verify door swing direction prior to rough-in.
- Q. To prevent sound from traveling through walls, electrical devices from different rooms shall not be mounted in the same stud place. Through-wall boxes shall not be used. In fire rated walls or partitions, outlet boxes on opposite sides of walls or partitions shall be separated by a horizontal distance of 24-inches. Outlet boxes larger than 4-inch square shall not be installed in fire rated walls or partitions, unless contractor provides fire barrier pads around outlet boxes to maintain fire rating of walls or partitions. Verify location of fire rated walls or partitions with Architectural drawings prior to rough-in.
- R. Mark all junction boxes and pull boxes with panel, circuit number, and voltage.
- S. All floor boxes shall be cleaned of all construction debris and dirt.
- T. Where fire rated 'poke-through' devices are specified, Contractor shall install devices after concrete pour and after final verification of location with Owner. Fire rated 'poke-through' devices shall be spaced apart from each other as required by the manufacturer and U.L.
- U. Sectional boxes shall not be used except where directed and approved by the Architect for installation in non-plastered tile walls and provided conduit connections are installed concealed in walls.
- V. Install all outlets in a secure and substantial manner and locate so as to be compatible with space, construction and equipment requirements and with the work of the other trades.
- W. Furnish and install plaster rings for all boxes installed in plastered (or gyp board) ceilings and walls. Verify construction with general construction drawings.
- X. Boxes for switches at or near doors shall be installed on the side opposite the hinge and within 6" of the door. Verify door swing direction prior to rough-in.

- Y. Rough-in outlets for electric water coolers so as to be concealed behind coolers, but remain accessible, in accordance with recommendation of equipment supplier.
- Z. Provide blank cover plates for all outlet boxes not used. Plates in finished areas shall match those specified for switch and receptacle devices. Blank cover plates for junction boxes supplied from the emergency system or fire alarm system shall be painted red.

END OF SECTION 26 05 30

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section includes the furnishing, installation and connection of panelboards.

PART 2 - PRODUCTS

2.1 PANELBOARDS:

- A. Panelboards shall be in accordance with UL, NEMA, NEC, and as shown on the drawings. Panelboards shall be by the same manufacturer as the remainder of the distribution equipment on the project. No mixing of manufacturers on the project. Approved manufacturers shall be as follows:

Panelboard Type	Square 'D'	Siemens ITE	General Electric	Cutler- Hammer
Branch Circuit Panelboard 240V	NQOD	P1	AL/AQ	PRL1
Branch Circuit Panelboard 480V	NF	P1	AE	PRL2
Circuit Breaker Distribution Panelboard	I-Line	S4&S5	Spectra	PRL3, PRL4
Fusible Distribution Panelboard	QMB	F1&F2	QMR	PRL4F

- B. Branch circuit and distribution panelboards rated up to 240V (400A. max) shall have a short circuit current rating tested to U.L. Standards for a minimum rating of 10,000 A.I.C. unless noted otherwise. Breaker rating with-in panel shall be equal to or greater than minimum integrated equipment rating. Series ratings will not be accepted, unless specifically noted otherwise on the drawings. All breakers shall be of either the plug-in type or bolt-on type.
- C. Branch circuit and distribution panelboards rated over 240V and up to 480V (400A max) shall have a short circuit current rating tested to U.L. Standards for a minimum rating of 14,000 A.I.C. unless noted otherwise. Breaker rating with-in panel shall be equal to or greater than minimum integrated equipment rating. Series ratings will not be accepted, unless specifically noted otherwise on the drawings. All breakers shall be of the bolt-on type only.
- D. Distribution panelboards located in finished rooms (other than mechanical, electrical or janitor rooms) shall be provided with key locking doors.
- E. Provide standard manufactured products. All components of panelboards shall be the product and assembly of the same manufacturer. All similar units of all panelboards to be of the same manufacturer.
- F. All panels shall be dead front safety type. Arrange sections for easy removal without disturbing other sections. All distribution panels in finished areas shall be provided with key locking doors. All panels in finished areas shall be recessed with flush type covers.

- G. All panelboards shall be completely factory assembled with molded case circuit breakers or switches.
- H. Panels shall have main breaker/switch or main lugs, bus size, voltage, phase, top or bottom feed, and flush or surface mounting as scheduled on the drawings.
- I. Panelboards shall have the following features:
 - 1. Non-reduced size tin plated copper bus bars (phase and neutral), and copper connection straps bolted together and rigidly supported on molded insulators. Bus bar tops for panels with single pole branches shall be arranged for sequence phasing of branch circuit devices. All lugs shall be AL/CU rated.
 - 2. Full size neutral bar shall be mounted on insulated supports. Provide 200% neutral bar for panels fed from K-rated transformer or as shown on drawings. Minimum number of lugs shall be equal to 90% of number of pole spaces in the panelboard, except in computer rated panelboards or isolated ground panelboards provide 100% of pole space lugs. Each neutral conductor shall be terminated under a separate lug.
 - 3. Copper ground bar with sufficient terminals for all grounding wires. Minimum number of lugs shall be equal to 90% of number of pole spaces in the panelboard, except in computer rated panelboards or isolated ground panelboards provide 100% of pole space lugs. Each ground conductor shall be terminated under a separate lug.
 - 4. Distribution panels located in finished rooms (other than mechanical, electrical rooms or janitor rooms) shall be provided with key locking doors.
 - 5. All breakers and phase bus connections shall be arranged so that it will be possible to substitute a 2-pole breaker for two single pole breakers, and a 3-pole breaker for three single pole breakers, when trip is 100 amps or less without having to drill and tap the main bus bars at bus straps.
 - 6. Design interior so that protective devices can be replaced without removing adjacent units, main bus connectors, and without drilling or tapping. Panel phase bus connections to protective devices shall not be riveted to the panel bus and shall be field removable by means of a screw driver.
 - 7. Where designated on panel schedule as "space", include all necessary bussing, device support, and connections. Provide blank cover for each space.
 - 8. In two section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed lugs on the line side or feed through lugs on the load side with cable connections to the second section. Panelboard sections with tapped bus or crossover bus shall not be accepted.
 - 9. Electrical Contractor shall coordinate lug quantities with the number of feeder conductors serving panelboard.
 - 10. All panelboards serving devices having isolated ground circuits shall be provided with an additional insulated copper ground bus for connection of isolated ground conductors.

2.2 CABINETS AND TRIMS:

A. Cabinets:

1. Provide galvanized steel cabinets to house panelboards. Cabinets for distribution panels may be factory primed and suitable treated with a corrosion-resisting paint finish meeting UL standard for outdoor applications.
2. Cabinet enclosure shall not have ventilating openings (225A. and less).
3. Back and sides shall be of one piece formed steel. Cabinets for distribution panels may be of formed sheet steel with end and side panels welded, riveted, or bolted as required.
4. Provide minimum of four interior mounted studs and necessary hardware for "in" and "out" adjustment of panel interior.
5. Flush mounted cabinets for two section panelboards shall have both sections bolted together, arranged side by side, shall be the same height and should be 1-1/2 inches apart and coupled by conduit nipple.
6. Gutter size in panel boxes, on all sides, shall be in accordance with the NEC. Cabinets containing through feeders shall have the gutters space increased by the amount required for auxiliary gutters in the NEC.

B. Trims and doors:

1. Panels shall have hinged covers with concealed trim clamps, doors shall have laser cut trims with concealed hinges, and flush lock, master keyed. Hinged cover shall have continuous piano hinge down one side with door opening by a single latch.
2. Flush trims shall overlap the box by at least 3/4-inch all around.
3. Surface trim shall have the same width and height as the box. Trim overlap or protruding past the box sides will not be allowed.
4. Flush or surface trims shall not have ventilating openings (225A. and less).
5. Secure trims to back boxes with indicating trim clamps.
6. Provide a welded angle on rear of trim to support and align trim to cabinet.
7. Provide separate trims for each section of multiple section panelboards. Doors of all sections shall be of the same height.
8. All branch circuit panelboards, and distribution panelboards with doors, shall be provided with key locking doors. Furnish two (2) keys for each lock to Owner.
9. Consult the drawings for flush or surface mounted panels.

C. Doors:

1. Provide concealed, butt hinges welded to the doors and trim.

2. For magnetic contactors incorporated in panelboards, provide separate interlocked doors for the contactors.
3. Provide keyed alike system for all panelboards.
4. Provide a typed directory card and metal holder, with transparent cover. Permanently mount holders on inside of doors.

D. Painting:

1. Thoroughly clean and paint trims and doors at the factory with primer and manufacturer's standard finish.

2.3 MOLDED CASE CIRCUIT BREAKERS FOR PANELBOARDS:

- A. Breakers shall be UL listed and labeled, in accordance with the NEC, as shown on the drawings, and as specified.
- B. Circuit breakers in panelboards shall be securely attached to the phase bus bar or branch circuit bar using the manufacturers standard method of attachment.
 1. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for 100 ampere frame or less. Magnetic trip shall be adjustable for breakers with 400 ampere frames and higher. Factory setting shall be used, unless otherwise noted.
 2. Molded case circuit breakers for lighting circuits shall be switching duty rated and suitable for use on HID lighting circuits.
 3. Ground fault circuit interrupter breakers (GFCI) for breakers less than 60 Amp shall be personnel protection (Class A) rated at 5 ma trip unless otherwise specified as equipment protection.
- C. Breaker features shall be as follows:
 1. A rugged, integral housing of molded insulating material.
 2. Silver alloy contacts.
 3. Arc quenchers and phase barriers for each pole.
 4. Quick-make, quick-break, operating mechanisms.
 5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
 6. Electrically and mechanically trip free.
 7. An operating handle which indicates ON, TRIPPED, and OFF positions.
 8. Line connections shall be bolt-on.
 9. An overload on one pole of a multi-pole breaker shall automatically cause all the poles of the breaker to open.

- D. Where new circuit breakers are noted on the drawings to be installed in existing panelboards, verify and coordinate the circuit breaker type and manufacturer with the existing panelboard.

2.4 SEPARATELY ENCLOSED MOLDED CASE CIRCUIT BREAKERS:

- A. Where separately enclosed molded case circuit breakers are shown on the drawings, provide circuit breakers in accordance with applicable requirements of those specified for panelboards.
- B. Enclosures are to be of the NEMA types shown on the drawings. Where the types are not shown, they are to be the NEMA type most suitable for the environmental conditions where the breakers are being installed.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Installation shall be in accordance with NEC, as shown on the drawings, and as specified.
- B. Where flush mounted panels occur on drawings contractor shall stub into nearest accessible ceiling void for future use, (1) 1 inch empty conduit for every four spare 20A. breakers or four unused panel spaces. For panels located on multi-floor buildings, conduits shall be stubbed into accessible ceilings both above and below panel. Conduits stubbed into ceiling void below panel shall be provided with conduit cap and labeled "To Panel Above".
- C. Locate panelboards so that the present and future conduits can be conveniently connected. Coordinate the sizes of cabinets with designated closet space.
- D. After wiring, label each circuit and install a typewritten schedule of circuits in each panelboard after approval by the Engineer. Schedule shall be typed on the paper directory cards. Include the room numbers and items served on the cards. Schedule shall indicate as-built conditions if circuiting is installed different than shown on the drawings. Schedule shall indicate final room numbering approved by Owner. Mark spare circuit breakers, and provisions for future circuit breakers, in pencil on schedule for future circuit marking.
- E. Mount the panelboard so that maximum height of circuit breaker or switch above finished floor shall not exceed 78 inches. For panelboards which are too high, mount panelboard so that the bottom of the cabinets will not be less than six inches above the finished floor.
- F. For panelboards located in areas accessible to the public, paint the exposed surfaces of the trims, doors, and boxes with finishes to match surrounding surfaces after the panelboards have been installed.
- G. Other than minor deviations approved by the Engineer, provide circuit breaker arrangement in panelboards to match circuit numbering on the drawings.
- H. All electrical distribution equipment (switchboards, panelboards, disconnect switches, transformers, starters, etc.) shall be of one manufacturer, unless specifically noted on the drawings, in the specifications, or approved by the Engineer. Intermixing of distribution equipment by different manufacturers will not be permitted.
- I. If layout changes are required due to other electrical manufacturers equipment size, they must be submitted to and approved by the Engineer prior to bidding. National Electric

Code working clearances must be maintained at all times. In no case will extra remuneration be allowed for layout changes that differ from those shown.

- J. All items of distribution equipment required to be floor mounted shall be mounted on a minimum 3 1/2" concrete base above floor. Concrete base to be by Electrical Contractor.
- K. Panel schedules are not shown on the drawings, however, copies of these schedules are available to the successful Contractor after bids are let, upon request to the Engineer.
- L. Enclosures are to be of the NEMA types shown on the drawings. Where the types are not shown, they are to be the NEMA types most suitable for the environmental conditions where the equipment is to be installed.
- M. All panelboards supplied from an emergency source shall have breakers provided with handle lock-off for each breaker. Breaker handles to be set in the "ON" position.
- N. Turn all spare circuit breakers in panelboards to off position.
- O. In addition to panel nameplate, provide a nameplate on the face of each branch circuit or distribution panel lettered: "WARNING, POTENTIAL ARC-FLASH HAZARDS EXIST WHILE WORKING ON THIS ENERGIZED EQUIPMENT". All distribution panels shall also have a nameplate for each circuit breaker or fusible switch indicating load served if the distribution panel is not furnished with a circuit directory.
- P. No piping, ductwork, or equipment foreign to the electrical installation shall be located in the electrical distribution equipment dedicated space as defined in N.E.C. Article 110.26 (F) (1). The Mechanical Contractor and Fire Sprinkler System Contractor shall locate ductwork and piping to clear the electrical distribution equipment dedicated space.

END OF SECTION 26 24 16

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section includes the furnishing, installation, and connection of wiring devices.

PART 2 - PRODUCTS

2.1 RECEPTACLES:

A. LIST OF ACCEPTABLE RECEPTACLE MANUFACTURERS:

Manufacturer:	Hubbell	Leviton	P&S	Cooper	Wiremold
1. Receptacles:					
Non-Hospital Grade:					
Duplex: 20A. 125V.	HBL5362	5362A	5362A	5362	-----
Ground Fault: 20A. 125V.	GF 5362	8899	2094	XGF20	-----
Isolated Ground: 20A. 125V.	IG 5362	5362-IG	IG-6300	IG5362	-----
Hospital Grade:					
Duplex: 20A. 125V.	8300	8300	9300HG	8300	-----
Ground Fault: 20A. 125V.	GF8300	8899-HG	2091-SHG	XHGF20	-----
Isolated Ground: 20A. 125V.	IG8300	8300	IG-8300HG	IG5362HG	-----
2. Surge Suppression					
Non-Hospital Grade: 20A. 125V.	HBL5362SA	5380	5362	5362	53SR20
Hospital Grade: 20A. 125V.	HBL8362SA	8380	-----	8300	-----
3. Clock Receptacle	HBL5235	5261-CH	S3733-SS	93632	-----

- B. Other manufacturers will be considered by the Engineer provided that specific device information is received by the Engineer prior to bid. No substitutions will be considered after bid letting.
- C. Devices located in patient care areas per N.E.C. Article "Health Care Facilities" shall be hospital grade. Devices located in non-patient care areas may be hospital grade or non-hospital grade as listed above.
- D. Where receptacles are indicated on the drawings as "WP" (weatherproof) or required by applicable codes to be weatherproof, they shall be G.F.C.I. duplex grounded receptacles.
1. Provide WP receptacles with a single lift hinged weatherproof coverplate for interior or exterior receptacles protected from the weather (not subjected to rain, water runoff, or hose down) or in other damp locations.
 2. Where interior or exterior WP receptacles are installed in wet locations (subjected to rain, water runoff, or hose down), provide non-metallic weatherproof cover, "Suitable for wet locations while in use", and UL Listed.
 - a. Taymac #MM400C-B

- b. Carlon E9UVC (vertical) or #E9UHC (Horizontal)
 - c. Intermatic #WP1000C (vertical) or WP1000HC (horizontal)
 - d. Cooper #4966 (vertical)
- E. See plans for special outlet schedule.
- F. Receptacle body shall be formed of high-impact thermoplastic or urea and receptacle contacts shall be Bronze. Receptacles shall be listed by U.L. and conform to NEMA standards as well as the latest Federal Specification W-C-596. Certification that receptacle meets or exceeds N.E.M.A. Standards shall be submitted to the Engineer for approval.
- G. All receptacles shall be self grounding with ground lug.
- H. Install receptacles to clear all cabinets, equipment, etc.
- I. Color of receptacles on normal power shall be AS SELECTED BY THE architect. (Unless noted otherwise). Receptacles on emergency power shall be Red in color. Verify normal power colors prior to ordering.
- J. All 120V, 15 or 20A receptacles in exterior locations, elevator machine rooms, elevator pits, toilets and restrooms, per NEC, and as located on the plans shall be ground fault circuit interrupters (GFCI) for personnel protection (Class A) with 5ma trip.
- K. Provide duplex receptacle on separate circuit beside each telephone terminal board location and other communications equipment requiring 120V, power.
- L. Where tamperproof receptacles are indicated on the drawings to be provided, receptacles shall be equal to Hubbell #HBL8300SGI, 20 amp, 125 volt, color as selected by Architect.
- M. Once device manufacturer has been selected, all devices and plates in the project shall be of one manufacturer, unless noted otherwise on the drawings or in the specifications.

2.2 TOGGLE SWITCHES:

- A. Wall Switches: Wall switches in general, used to control lighting, shall be quiet operating, listed by U.L. and conform to NEMA standards as well as the latest Federal Specification W-S-896e.
- B. Switches shall be single pole, two-pole, three-way, four-way, keyed, and with pilot light as called for on the drawings. Groups of switches shall be under one gangplate. Where switches are in fire rated walls groups of switches shall be maximum of two (2) gangs under one cover plate.
- C. Switches shall be as follows unless specified otherwise.

Single Pole	20 A. 125 V. 277 V.
Two Pole	20 A. 125 V. 277 V.
Three-Way	20 A. 125 V. 277 V.
Four-Way	20 A. 125 V. 277 V.
Pilot Light	20 A. 125 V. 277 V.
Key Switch	20 A. 125 V. 277 V.

- D. All switches shall be self grounding w/ground lugs.
- E. List of acceptable switch manufacturers:

Manufacturer:	P&S	Hubbell	Leviton	Cooper	
Toggle Switches	20AC1 Series	1221 Series	1221-2 Series	2221 Series	
Key Switches:	20AC1-L Series	HBL 1220-L Series	1221-2L Series	2221L Series	
Pilot Light Switches	20AC1-CP L Series	HBL 1220-PL Series	1221-PL R Series	2221PL Series	

- F. Other manufacturers will be considered by the Engineer provided that specific device information is received by the Engineer prior to bid. No substitutions will be considered after bid letting.
- G. Pilot light switches shall be illuminated toggle switch lighted red in "on" position. Key switches shall be master keyed.
- H. Color of switches on normal power shall be as selected by the Architect. (unless noted otherwise) Switches on emergency power shall be Red in color.. Verify normal power colors prior to ordering.
- I. Provide barriers between 277V. switches, between 277V. and 120V. switches, and between combination 277 volt switches/120 volt receptacles installed in a common outlet box.
- J. Incandescent wall box dimmers shall be linear slide type with smooth face plates, no exposed cooling fins, equal to Lutron NT-600, NT-1000, or NT-1500 for loads to 1500W. For Loads 1500W to 2000W, Lutron N-2000. For multigang dimmer installations, derate dimmer wattage per manufacturers requirements, or install dimmers in separate outlet boxes. Verify color of face plate and dimmer with Architect prior to ordering. Dimmer switches for fluorescent and compact fluorescent light fixtures shall be slide type, equal to Lutron. Fluorescent and compact fluorescent dimmer switches shall be compatible with the ballast used with the light fixture. Coordinate with ballast manufacturer. Dimmers shall be provided with required filtering and of the types (solid state, low voltage) as required for the lamps connected. Lamp hum will not be tolerated.
- K. Once device manufacturer has been selected, all devices and plates in the project shall be by the same manufacturer, unless noted otherwise on the Drawings or in the Specifications.

2.3 WALL PLATES:

- A. All wall plates shall be High-Impact Thermoplastic or Nylon (not Thermoset), smooth surface wall plates. Where plates are noted to be engraved or labeled, provide stainless steel wall plates in color to match other plates and provide engraved filled letters. If approved by the Engineer, high-impact thermoplastic plates with filled letters may be used for engraving provided that a sample plate is submitted for approval. Stainless steel plates where used or specified shall be .032" nominal thickness, non-magnetic.
- B. Color shall be as selected by the Architect for devices on normal power (unless noted otherwise), red for devices on emergency power.

- C. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.
- D. Provide blank plates for all telephone, cable TV, communication outlets not used by telephone, cable TV, or communications installers.
- E. All emergency receptacle and switch cover plates shall indicate panel name and circuit number from which the device is served.
- F. Plates shall be set plumb and parallel with the wall. There shall be no gap between the plate and the wall surface.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Installation shall be in accordance with the NEC, and as shown on the drawings.
- B. Switches shall be located on the latch side of all doors. If switches must be located on the hinge side of a door, they shall be located so that they are not behind the door when it is open. All questionable locations shall be brought to the Engineers/Architects attention prior to rough-in.
- C. Verify all outlet locations on the job prior to rough-in. Locations may be altered up to 6'-0" in any direction as directed by the Architect or Engineer without additional cost to the Owner.

END OF SECTION 16 140

SECTION 26 28 16 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section includes all low voltage disconnect switches either stand alone in NEMA enclosures, fusible and non-fused, in panelboards, switchboards, or switchgear.

1.2 APPROVED MANUFACTURERS:

Square 'D'
General Electric
Siemens/ITE
Cutler Hammer

Disconnect switches shall be by the same manufacturer as the remainder of the distribution equipment on the project. No mixing of manufacturers on the project.

PART 2 - PRODUCTS

2.1 LOW VOLTAGE FUSIBLE SWITCHES RATED 800 AMPERES AND LESS:

- A. Quick-make, quick-break type in accordance with UL 98, NEMA KS 1 and NEC.
- B. Shall be capable of accepting UL and NEMA standard fuses.
- C. Shall have the following features:
 - 1. Switch mechanism shall be the quick-make, quick-break type.
 - 2. Copper blades, visible in the OFF position.
 - 3. An arc chute for each pole.
 - 4. External operating handle shall indicate ON and OFF position and shall have lock-open padlocking provisions.
 - 5. Mechanical interlock shall permit opening of the door only when the switch is in the OFF position, defeatable by a special tool to permit inspection.
 - 6. Fuse mounting for the size and type of fuses specified. Furnish switches completely fused. Furnish a complete set of spare fuses for each size and type of fuse being installed.
 - 7. Solid neutral for each switch being installed in a circuit which includes a neutral conductor.
 - 8. Enclosures:
 - a. Shall be NEMA 1 for interior, NEMA 3R for exterior and other types shown on the drawings for the switches.

- b. Where the types of switch enclosures are not shown, they shall be the NEMA types which are most suitable for the environmental conditions where the switches are being installed.
 - 9. All fuse holders shall have rejection features to reject all fuses not specified. Provide fuse rejection kits as required.
 - D. Unless indicated otherwise, switches shall be heavy duty, horsepower rated for the load served, and provided with ground kit.
 - E. All disconnect switches shall be fused except for disconnect switches that have individual fuse protection at point circuit receives its supply.
 - F. Provide dead front type for all exterior disconnects on grade level when so required by local code.
 - G. All fused disconnect switches shall have a minimum rating of 100,000 A.I.C. with fuses installed unless noted otherwise on the drawings.
- 2.2 LOW VOLTAGE UNFUSED SWITCHES RATED 800 AMPERES AND LESS:
- A. Shall be the same of Low Voltage Fusible Switches rated 800 amperes and less, except it shall not accept fuses.
- 2.3 THERMAL OVERLOAD SWITCHES:
- A. Provide/install toggle type switches, voltage and horsepower rated for the load served 20 or 30 Amp for all small mechanical equipment as indicated.
- 2.4 FUSES:
- A. This paragraph applies to all fuses provided under Division 26.
 - 1. Cartridge type fuses of proper size and type as required shall be furnished and installed for all switches and panelboards throughout and an additional supply of three spare fuses of each size and type shall be furnished in original packages to the Owner. Furnish NEMA 1 enclosure with hinged cover equal to Bussmann Type SFC or Edison ESFC, for storing all spare fuses located adjacent to main service equipment. Fuses for motor and mechanical equipment shall be sized per nameplate data and N.E.C.
 - 2. Fuses shall be manufactured by Bussmann Mfg. Co., Ferraz-Shawmut Co., Littelfuse or approved equal by Engineer. Fuse types shall be installed as follows:

Main Service and Distribution Feeder Protection:

	Bussman	Littelfuse	Ferraz Shawmut
601 amps and larger 600 volts and less (Class L)	KRP-C/KTN	KLPC	A4BQ
600 amps and less 250 volts and less (Class RK1)	LPN-RK	LLN-RKA2D-R	

600 amps and less
600 volts and less (Class RK1)

LPS-RK

LLS-RKA6D-R

Motors and Primary Feeders for Transformers:

250 volts and less
(Class RK5)

FRN-R

FLN-R

TR-R

600 volts and less
(Class RK5)

FRS-R

FLS-R

TRS-R

3. Class T fuses will not be accepted, unless they are a part of a manufacturers assembly or approved by the Engineer. Class J fuses may be used as an alternate to the Class R fuses listed above.
4. Fuses installed on project shall be by one manufacturer only. (Do not intermix Manufacturers.)

2.5 – EQUIPMENT CONNECTIONS:

- A. For 120 volt motors 1/2 HP- and less, 15 amperes and less, Contractor shall provide Bussmann "SSY" box cover unit for indoor application and "SSN" box cover unit for outdoor applications, or equal by Perfect-Line, with fustat plug fuse and integral toggle switch for motors 1/2 HP-120V. and less. Fustats for cord and plug equipment with fuses 15 amperes and less shall be Bussmann "SRY" box cover unit, or equal by Perfect-Line, with fustat plug fuse. Mount fustats in housings of equipment served wherever possible. Plug fuses for motors shall be sized based upon 125% of manufacturer's nameplate full load amperage unless otherwise indicated on drawings.
- B. For 3/4 HP-120V. motors, Contractor shall provide (1) 20 amp 1 pole 120 volt toggle disconnect switch with a Bussmann 'HPD' fuse holder and 'FNQ-R' fuse at each unit. Switch and fuse holder to be mounted in cover of a 4" square, 2 1/8" deep junction box at each unit. For 3/4 HP-120V. motors that are provided with cord and plug, Contractor shall provide 20 amp 120 volt duplex receptacle with (1) 20 amp 1 pole 120 volt toggle disconnect switch on line side of receptacle, and Bussmann 'HPD' fuse holder and 'FNQ-R' fuse on line side of receptacle. Switch, receptacle, and fuse holder to be mounted in cover of a 4" square, 2 1/8" deep junction box at each unit. Fuses for motors shall be sized based upon 125% of manufacturer's nameplate full load amperage unless otherwise indicated on drawings.
- C. For connections to 277 volt equipment, Contractor shall provide (1) 20 amp 1 pole 277 volt toggle disconnect switch with a Bussmann 'HPD' fuse holder and 'FNQ' fuse at each unit. Switch and fuse holder to be mounted in cover of a 4" square, 2 1/8" deep junction box at each unit. Fuses for motors shall be sized based upon 125% of manufacturer's nameplate full load amperage unless otherwise indicated on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Installation shall be in accordance with the NEC and as shown on the drawings.

- B. Enclosures shall be of the NEMA types shown on the drawings. Where the NEMA type is not shown, they are to be the NEMA type most suitable for the environmental conditions where the equipment is to be installed.
- C. No piping, ductwork, or equipment foreign to the electrical installation shall be located in the electrical distribution equipment dedicated space as defined in N.E.C. Article 110.26 (F) (1). The Mechanical Contractor and Fire Sprinkler System Contractor shall locate ductwork and piping to clear the electrical distribution equipment dedicated space.

END OF SECTION 26 28 16

SECTION 26 29 13 - MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section includes all motor starters and motor control stations, either stand alone in NEMA enclosures, combination type with disconnect, or in panelboards or motor control centers.

PART 2 - PRODUCTS

2.1 MOTOR STARTERS:

- A. Approved manufacturers: Square 'D', Cutler Hammer, Siemens/ITE, or General Electric. NEMA and NEC shall apply. Starters shall be by the same manufacturer as the remainder of the distribution equipment on the project. No mixing of manufacturers on the project.
- B. All starters shall be fully NEMA rated. I.E.C. rated starters will not be allowed. Starters shall have all components made by one manufacturer, and shall have the following features:
 - 1. Enclosed type as shown on the drawings.
 - 2. Safety switches within the motor controller enclosures shall have external operating handles with lock-open padlocking provisions and shall indicate the ON and OFF positions.
 - 3. Motor control circuits:
 - a. Shall operate at not more than 120 volts.
 - b. Shall be grounded except as follows:
 - 1) Where isolated control circuits are shown.
 - 2) Where manufacturers of equipment assemblies recommend that the control circuits be isolated.
 - c. Incorporate a separate, heavy duty, control transformer within each motor controller enclosure to provide the control voltage for each motor operating over 120 volts.
 - d. Incorporate primary and secondary overcurrent protection for control power transformers in accordance with the NEC.
 - 4. Overload current protective devices:
 - a. Thermal or solid state induction type Class 20. Class 10 will not be acceptable.
 - b. One for each pole.

- c. Manual reset on the door of each motor controller enclosure.
 - d. Overload thermal units shall be sized on the basis of actual motor nameplate current. Overloads shall be non-adjustable NEMA standard trip and shall be available in sizes covering the complete NEMA horsepower.
 - e. Check every motor controller after installation and verify that correct sizes of protective devices have been installed.
- 5. Auxiliary contacts, H-O-A selector switches, green "off" and red "on" pilot light push-buttons shall be provided. One closed contact when the starter is deactivated and one closed contact when the starter is activated.
- 6. Other devices and accessories as shown on the drawings or otherwise required by control drawings and approved shop drawings.
- 7. Enclosures:
 - a. Shall be NEMA 1 for interior, NEMA 3R for exterior and other types as shown on the drawings for the motor controllers.
 - b. Where the types of motor controller enclosures are not indicated, they shall be the NEMA types which are the most suitable for the environmental conditions where the motor controllers are being installed.
 - c. Doors shall be mechanically interlocked to prevent opening unless the breaker or switch within the enclosure is open.
 - d. Thoroughly clean and paint the enclosures at the factory with manufacturer's prime coat and standard finish.
- 8. Each controller for motors 10 HP and larger shall be equipped with a 3 phase sensing loss of phase relay with automatic reset. Equal to Time Mark model 258.
- C. Motor controllers incorporated with equipment assemblies shall also be designed for the specific requirements of the assemblies.
- D. Additional requirements for specific motor controllers, as indicated in other sections, shall also apply.
- E. Install a disconnect safety switch near and within sight of each motor. Combination type switch/starter in one enclosure are acceptable if listed as one piece. Switches shall comply with Section 26 28 16.
- F. Reduced Voltage Motor Controllers (Only where indicated on the drawings):
 - 1. Shall be installed for all motors 25HP and larger and where shown on the drawings.
 - 2. Shall be auto transformer as indicated on the drawings, or included in the temperature control section of these specifications.
 - 3. Shall have closed circuit transition for the types which can incorporate such transition.

4. Shall limit inrush currents to not more than 70 percent of the locked rotor currents.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Installation shall be in accordance with the NEC, and as shown on the drawings.
- B. Enclosures are to be of the NEMA types shown on the drawings. Where the types are not shown, they are to be the NEMA type most suitable for the environmental conditions where the equipment is to be installed.
- C. No piping, ductwork, or equipment foreign to the electrical installation shall be located in the electrical distribution equipment dedicated space as defined in N.E.C. Article 110.26 (F) (1). The Mechanical Contractor and Fire Sprinkler System Contractor shall locate ductwork and piping to clear the electrical distribution equipment dedicated space.

END OF SECTION 26 29 13

SECTION 26 51 00 - BUILDING LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section includes the furnishings, installation of and connection of all building lighting.
- B. Fixtures shall be completely free of defects, dents, rust or chipped surfaces. No cracked, broken, or chipped lenses will be acceptable. Fixtures that are cracked, broken, chipped, rusted, dented or otherwise damaged, shall be replaced without additional cost to the Owner. Fixtures shall be furnished complete including hickey, suspension nipples, and all other materials and equipment as required for hanging and supporting fixtures. All recessed mounted fixtures shall be mounted with the trim flush to the finish ceiling or wall surfaces, free of gaps or cracks.
- C. Electrical Contractor shall verify exact ceiling types in all areas with architectural room finish schedule for exact fixture mounting (i.e., grid or flange type mounting) prior to ordering of fixtures. Electrical Contractor shall verify ceiling construction details in all areas and provide appropriate mounting hardware for installation of lighting fixtures.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES:

- A. Shall conform to the detail drawings, NEC Article "Luminaires (Lighting Fixtures), Lampholders, And Lamps", and UL-57.
- B. Sheet Metal:
 - 1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved), and parallel to each other as designed.
 - 2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.
 - 3. Where lighting fixture types are detailed with minimum 20 gauge (0.035 inch) housing, minimum 22 gauge (0.029 inch) housings will be acceptable provided they have strengthening embossed rib and break formations, and meet the rigidity test requirements of Fed. Spec. W-F-1662.
 - 4. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.
 - 5. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, and latches shall function easily by finger action without the use of tools.
- C. Ballasts shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified.
- D. Lamp Sockets:

1. Fluorescent: Lampholder contacts shall be as standard by the manufacturer and shall conform to the applicable requirements of UL 542 and ANSI C-81. Lampholders for bi-pin lamps, with the exception of those for "U" type lamps, shall be of the telescoping compression type, or of the single slot entry type requiring a one quarter turn of the lamp after insertion. Lampholders for compact fluorescent lamps shall be 4-pin.
 2. High Intensity Discharge (H.I.D.): Shall have porcelain enclosures and conform to the applicable requirements of ANSI C-81.
 3. Incandescent: Shall have porcelain enclosures and conform to the applicable requirements of UL 496.
- E. Recessed incandescent fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.
- F. Fluorescent fixtures with louvers or light transmitting panels shall have doors with hinges, captive spring loaded latches, and safety catches to facilitate safe, convenient cleaning and relamping. Vaportight fixtures shall have pressure clamping devices in lieu of the latches.
- G. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by screws, chains, captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.
- H. Metal Finishes:
1. The manufacturer shall apply a standard finish (unless otherwise specified) over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking.
 2. All fluorescent fixtures shall be provided with factory applied powder coat baked enamel finish, applied after final fabrication, for all parts (housing, door, end plates, ballast covers, socket channels, etc) unless specifically noted otherwise on the lighting fixture schedule or drawings. Fixtures using pre-painted metal components will not be acceptable.
 3. Interior light reflecting finishes shall be white with not less than 92 percent reflectances, except where otherwise shown on the drawing.
 4. Exterior finishes shall be as shown on the drawings.
- I. Fluorescent Lamp Ballasts:
1. Ballasts shall be provided in one or two lamp configurations. Three or four lamp electronic ballasts will not be allowed unless noted otherwise on the drawings, or as provided in "Master-Satellite" wiring arrangements.
 2. When different lamps in the same fixture are controlled by separate switches (2 or 3 level lighting), the switches shall control the same lamp positions in all fixtures controlled by those switches. Arrangement of switching will generally be that the first switch controls the outside lamps, and the second switch controls the middle lamp or lamps unless noted otherwise on the drawings.

3. All ballasts shall be labeled or listed by UL or ETL. Case marking shall also indicate the required supply voltage, frequency, RMS current, current surge during starting, input watts, and power factor at the designed voltage, open circuit voltage, crest factor and efficacy.
4. Submit, simultaneously with shop drawings, a certified test report by an independent testing laboratory showing that the ballasts meet or exceed all the performance requirements in this specification.
5. Ballasts shall be provided in voltages to match connected circuits. Verify circuit voltage prior to ordering light fixtures.
6. High-Frequency electronic ballasts for T8 lamps:
 - a. General Requirements: Unless otherwise indicated, features include the following:
 - (1) Designed for type and quantity of lamps indicated at full light output.
 - (2) Operating Frequency: 20 kHz or higher.
 - (3) Voltage Range: +/- 10 percent of rated input.
 - (4) Total Harmonic Distortion Rating: Less than 20 percent.
 - (5) Power Factor: Greater than 97 percent.
 - (6) Lamp Current Crest Factor: 1.7 or less.
 - (7) Sound Rating: Class A or better.
 - (8) Starting Temperature: 50 degree Fahrenheit minimum for fixtures installed in conditioned spaces, 0 degree Fahrenheit minimum for fixtures installed exterior of building or in non-heated areas of the building.
 - (9) Transient Protection: Comply with IEEE C62.41, Location A2.
 - (10) Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
 - (11) Ballasts shall be secured by a minimum of two bolts.
7. High-Frequency electronic ballasts for T5 and T5HO lamps:
 - a. General Requirements: Unless otherwise indicated, features include the following:
 - (1) Designed for type and quantity of lamps indicated at full light output.
 - (2) Operating Frequency: 20 kHz or higher.
 - (3) Voltage Range: +/- 10 percent of rated input.
 - (4) Total Harmonic Distortion Rating: Less than 10 percent.
 - (5) Power Factor: Greater than 98 percent.
 - (6) Lamp Current Crest Factor: 1.7 or less.
 - (7) Sound Rating: Class A or better.
 - (8) Starting Temperature: 50 degree Fahrenheit minimum for fixtures installed in conditioned spaces, 0 degree Fahrenheit minimum for fixtures installed exterior of building or in non-heated areas of the building.
 - (9) Transient Protection: Comply with IEEE C62.41, Location A2.

- (10) Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
 - (11) Ballasts shall be secured by a minimum of two bolts.
 - (12) Ballasts shall incorporate lamp shutdown circuiting for end-of-lamp-life lamp protection.
- 8. Electronic ballasts for Linear lamps: Unless otherwise indicated, features include the following, in addition to those in "General Requirements" Paragraph above:
 - a. Certified Ballast Manufacturer Certification: Indicated by label.
 - b. Encapsulation: Without voids in potting compound.
 - c. Parallel Lamp circuits: Multiple lamp ballasts connected to maintain full light output on servicing lamps if one or more lamps fail.
- 9. Ballasts for Compact Lamps: Unless otherwise indicated, features include the following, in addition to those in "General Requirements" Paragraph above:
 - a. Designed for type and quantity of lamps indicated at full light output.
 - b. Operating Frequency: 20 kHz or higher.
 - c. Voltage Range: +/- 10 percent of rated input.
 - d. Total Harmonic Distortion Rating: Less than 20 percent.
 - e. Power Factor: Greater than 97 percent.
 - f. Lamp Current Crest Factor: 1.7 or better.
 - g. Sound Rating: Class A or better.
 - h. Starting Temperature: 50 degree Fahrenheit minimum for fixtures installed in conditioned spaces, 0 degree Fahrenheit minimum for fixtures installed exterior of building or in non-heated areas of the building.
 - i. Transient Protection: Comply with IEEE C62.41, Location A2.
 - j. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
 - k. Ballasts shall have end-of-life protection circuit and cutoff to prevent welding of lamps in sockets or lamp breakage.
- 10. Ballasts for Dimmer-Controlled Fixtures: Comply with general and fixture-related requirements above for electronic ballasts.
 - a. Compatibility: Certified by manufacturer for use with specific dimming system indicated.
 - b. Ballasts shall be high frequency electronic type, dimmable 100%-5%.
 - c. Positive starting at all dimming levels.
 - d. No lamp dropout.
 - e. No flicker at all dimming levels.
- 11. Ballasts shall be as manufactured by Sylvania, Motorola, Magnatek, Universal, Jefferson, Howard, or Advance.
- K. Ballasts for High Intensity Discharge Fixtures:
 - 1. Shall have individual overcurrent protection sized in accordance with the manufacturer's recommendations.
 - 2. Shall have integral thermal protection where the fixture is recessed in an interior ceiling.

3. Shall be the constant wattage, high power factor type or the reactor high power factor type. Capacitors shall not contain PCB (Polychlorinated Biphenyl) fluids or other fluids recognized as hazardous when discharged into the environment.
 4. Shall have not less than B sound ratings for interior fixtures, when available. Ballasts which are not available with B ratings shall be of the highest available rating.
 5. Ballasts shall be Jefferson, Sylvania, Universal, Magnetek, or Advance.
- L. Provide all lighting fixtures with a specific means for grounding their metallic wireways and housings to an equipment grounding conductor.
- M. Lighting Transmitting Components for Fluorescent Fixtures:
1. Shall be 100 percent virgin acrylic plastic and nominal .125 inch thick (minimum thickness shall be no less than 0.115" thick). Styrene lenses shall not be provided for any fixture.
 2. Unless otherwise specified lenses and diffusers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction of the lens without distortion or cracking. At final inspection, all lens that sag or do not lay down flat shall be replaced by the manufacturer.

2.2 LAMPS:

- A. Lamps shall be as follows. Once a manufacturer has been selected, all lamps on the project shall be by the same manufacturer.
1. Linear Fluorescent Lamps:
 - a. Except as indicated on the drawings, lamps shall be T8, T5, or T5HO as specified on the drawings. Lamps shall have a correlated color temperature as specified on the drawings, or as specified by the Architect. Verify all lamp correlated color temperatures prior to ordering lamps
 - b. Fluorescent lamps, unless noted otherwise on the drawings, shall be Sylvania Octron "800" series for T8 lamps, Sylvania Pentron High Performance "800" series for T5 lamps, or Sylvania Pentron High Output High Performance "800" series for T5HO lamps, or equal by Phillips, G.E. or as approved by the Engineer. Verify all lamp correlated color temperatures with Architect prior to ordering.
 2. Compact Fluorescent Lamps:
 - a. Except as indicated on the drawings, lamps shall be 4-pin compact fluorescent. Lamps shall have a correlated color temperature as specified on the drawings, or as specified by the Architect. Verify all lamp correlated color temperatures prior to ordering lamps.
 - b. Compact fluorescent lamps, unless noted otherwise on the drawings, shall be Sylvania Dulux D/E or Dulux T/E, or equal by Phillips, G.E., or as approved by the Engineer. Verify double or triple tube lamps with light

fixture and lamp specified on the Drawings. Verify all lamp correlated color temperatures with Architect prior to ordering.

3. High Intensity Discharge Lamps:
 - a. In all cases, provide lamps that are approved by and designed for use by the fixture manufacturer. Typically lamps for interior down lights shall be coated, those for exterior and industrial fixtures shall be clear.
 - b. Metal halide lamps for interior use shall be Metalarc/c coated. Metal halide lamps for exterior use shall be clear. Metal halide lamps shall be as manufactured by G.E., Sylvania, Philips, or equal approved by the Engineer. Refer to lighting fixture manufacturer for lamp type.
 - c. High pressure sodium lamps shall be Lumalux/D (coated) as manufactured by G.E., Sylvania, Philips, or equal approved by the Engineer. Refer to lighting fixture manufacturer for lamp type.
4. Incandescent lamps shall be the general service, inside frosted type rated 130 volts except where otherwise shown on the drawings. Incandescent lamps shall be as manufactured by Philips, G.E., Sylvania, or equal approved by the Engineer.
5. MR16 lamps shall be color consistent, minimum 4,000 average rated hour lamp. All MR16 lamps shall be provided with UV shielding.

2.3 EMERGENCY LIGHTING AND POWER:

- A. When emergency battery power packs are optional to the specified exit signs and emergency fixtures and are not included in the model number in the light fixture schedule, the emergency battery power packs shall be included as part of the specified fixture when they are not connected to an emergency generator system. Verify on drawings.
- B. Emergency operation of fluorescent fixtures:
 1. Fluorescent fixtures shown in the fixture schedule to contain a battery charger and battery shall be supplied with a factory installed sealed replaceable nickel cadmium battery and a solid state inverter charger and switch systems.
 2. The emergency Battery Section shall be connected on the same circuit as the light ahead of any switches or contactors controlling area lights so that emergency lighting is maintained at all times. Other lamps not on emergency system in same fixture will be switched with area lights. Lamp sockets in Emergency Fluorescent fixtures shall be in the exact same position as lamp sockets in non-emergency fixtures of the same type and number of lamps. All components shall be contained within the fixture. The emergency battery system shall operate two lamp (1000 lumen minimum) for a minimum of 90 minutes. Battery charger shall be capable of recharging batteries to full charge within 24 hours after complete discharge. Fixture shall contain pilot light to indicate charger condition and a test switch to simulate power failure. Systems shall be unconditionally guaranteed for three (3) years by emergency unit. Units shall be manufactured by Bodine, Universal, Iota, or approved by Engineer.

C. Exit Signs And Other Emergency Fixtures:

1. Provide emergency battery power packs on all exit signs and emergency fixtures that are not connected to an emergency generator.
2. Batteries shall be lead calcium, pure lead, or nickel cadmium as indicated on the drawings. Lead acid will not be accepted. Batteries shall be unconditionally guaranteed for 5 years with a 10 year prorated warranty from the factory. Units shall be Underwriter's Laboratory listed and labeled as an emergency unit. Batteries shall be provided as standard or as optional equipment of the same series of the specified fixtures.
3. The emergency Battery Section shall be connected on the same circuit as the area lighting, ahead of any switches or contactors controlling area lights so that emergency lighting is maintained at all times.

2.4 LIGHTING CONTROL EQUIPMENT:

- A. See the drawings for the arrangement and method of control. Controls shall operate at 120 volt. Connect to the nearest 120 volt panel or as shown on the drawings.

B. Contactors And Relays:

1. Shall be as manufactured by Cutler-Hammer, Allen Bradley, G.E., Siemens/ITE, or Square 'D'. They shall be as sized on the drawings.
2. All contactors and relays shall be Tungsten rated.

C. Time Switches:

1. Time switches by Tork, Intermatic, and Paragon equal to those listed on the drawings or indicated below and approved by the engineer will be acceptable.
2. Exterior lighting or interior time switches shall be Intermatic ET70115C Series 7 day 20A., SPDT with carry-over.
3. All time switches shall be provided with momentary contacts if required.
4. All time switches shall be provided with manual bypass switches and standby battery systems.
5. Set time switches per Owners requirements.

D. Photo Electric Controls:

1. Photo Electric Controls by Tork, Intermatic and Paragon equal to those indicated below and approved by the Engineer will be acceptable.
2. Photo Electric Controls (Photo switches; Photo cells) shall be Intermatic #K4133 rated at 3000W, 277 volts, or #K4121 rated at 1800W, 120 volts, weatherproof. Mount on roof and orient photo electric controls to the north. Photo-electric controls supplied as a part of a fixture assembly shall be as provided by fixture manufacturer.
3. Photo Electric Controls installed on light fixtures shall be supplied in finish to match the light fixture.

- E. When a photo cell and time clock are specified for combination control, they shall be connected in series. The time clock to be on during the day, the photo cell will turn the lights on during the day if a storm passes over and at dusk. Set the time clock to turn the lights off in the evening and back on before sunrise per the owners requirements. At sunrise, the photo cell will turn the light off.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Installation shall be in accordance with the NEC, and as shown on the drawings.
- B. Align, mount and level the lighting fixtures uniformly.
- C. Avoid interference with and provide clearance for equipment. Where the indicated locations for the lighting fixtures conflict with the locations for equipment, change the locations for the lighting fixtures by the minimum distances necessary as approved by the Engineer.
- D. For suspended lighting fixtures, the mounting heights shall provide the clearances between the bottoms of the fixtures and the finished floors as shown on the drawings. Verify all heights with the Architect prior to mounting.
- E. Lighting Fixture Supports:
 - 1. Shall provide support for all of the fixtures in accordance with U.L., U.B.C., and N.E.C. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
 - 2. Shall maintain the fixture positions after cleaning and relamping.
 - 3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
 - 4. Hardware for recessed fluorescent fixtures:
 - a. Where the suspended ceiling system is supported at the four corners of the fixture opening, hardware devices shall clamp the fixture to the ceiling system structural members, or plaster frame at not less than four points in such a manner as to resist spreading of the support members and safely lock the fixture into the ceiling system.
 - b. Where the suspended ceiling system is not supported at the four corners of the fixture opening, hardware devices shall be furnished by E.C. to independently support the fixture from the building structure at four points.
 - c. In all cases, four NEC approved clips shall be installed to firmly attach the fixture to the ceiling.
 - 5. Hardware for surface mounting fluorescent fixtures to suspended ceilings:
 - a. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of

each fixture. The bolts shall be not less than 1/4-inch secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.

- b. In addition to being secured to any required outlet box, fixtures shall be bolted to a plaster ceiling at four points spaced near the corners of each fixture. Pre-positioned 1/4-inch studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 1/4-inch toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.
- 6. Provide safety supports from ballast or fixture housing up to structure above for all fixtures weighing more than 15 lb. Supports shall be chains, aircraft cable, factory or field fabricated and rated in excess of twice the weight of the fixture.
- F. Provide and install new lamps for each new lighting fixture installed and for each existing lighting fixture reinstalled.
- G. Contractor shall coordinate between the electrical and ceiling trades to ascertain approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed. Lay-in type fixture installed in sheet rock ceilings shall be provided with a flange and bolted to the ceiling.
- H. Connections to all fixtures mounted in lay-in ceilings shall be as follows:
 - 1. Provide J-Box on structure above fixtures for power circuit supply connections. Install U.L. listed 3/8" flexible (min.) steel conduit (whip) down to each fixture. Each whip shall be field cut to length to allow fixture to be relocated up to 4'-0" in any horizontal direction. Whips shall include (2) or (3) #12 AWG Copper, 90 degree rated, conductors (numbers as indicated) and a #12 AWG Copper ground conductor. Fixtures factory supplied with U.L. listed whip assemblies shall also be provided with the conductors as listed above. Tandem fluorescent fixtures shall have a factory supplied U.L. listed 3/8" flexible (min.) whip assembly with conductors as required to interconnect fixtures, and be of sufficient length to allow mounting fixtures 12'-0" on center in any horizontal direction.
 - 2. Contractor may use a pre-manufactured flexible wiring system for light fixture connections. System shall be similar to "AFC" systems and shall not be used for switch drops or systems other than lighting.
 - 3. If tandem wired fixtures are used, the maximum whip length between fixtures for electronic ballasts shall be 9 feet.
- I. Wipe fixtures, lamps, lens, and louvers clean at end of project completion.
- J. General Contractor shall provide fireproofing around recessed fixtures installed in fire-rated ceilings per U.L. requirements, Electrical Contractor shall coordinate.
- K. Provide clear tempered glass shields on all metal halide, and quartz fixtures. Exterior fixtures shall be constructed with gasketed shield and be "bugtight".

- L. Provide thermal switches on all recessed fixtures as required by N.E.C.
- M. Where fluorescent fixtures are mounted in continuous rows, each row shall be supplied with 2 #12 AWG & 1 #12 AWG "green" ground, 90 degree C. rated, Copper conductors, all within 1/2" flexible steel conduit. Feed through wiring shall also be #12 AWG. 90 degree C. copper. Where flexible steel conduit is to be used, all fittings shall be U.L. labeled for the purpose.

END OF SECTION 26 51 00

SECTION 27 00 00 – COMMUNICATIONS SYSTEMS (CONDUIT)

PART 1 - GENERAL

1.1. SUMMARY:

- A. Scope: Extent of communications systems work is indicated by drawings, specifications, and details, and as hereby defined to include, but not be limited to telephone, data, and CATV conduits, boxes, terminals, and other associated equipment and hardware.
- B. Provide submittals on all products specified with this section.
- C. All cabling materials, cabling, electrical ends, jacks, patch panels, racks, etc. will be provided and installed by the Contractor or his sub-contractor, unless otherwise noted on the drawings or in the specifications. Cable installer shall be certified for system installed.

1.2. QUALITY ASSURANCE:

- A. Codes and Standards: Conform to the following:
 - 1. National Electrical Code (NEC): comply with applicable local code requirements of the authority having jurisdiction and NEC.
 - 2. This installation must be done according to the requirements of the local system supplier and the general specifications contained herein. Consult the serving installers to verify all requirements.

PART 2 – PRODUCTS

2.1. TELEPHONE SYSTEM:

- A. Outlets: All telephone outlet boxes shall be installed with 4" square, minimum 2 1/8" deep box and trim. Telephone coverplates to be as furnished by contractor unless noted otherwise on the drawings. All floor outlets shall be adjustable water-tight floor box, installed in existing underfloor raceway system. All telephone outlet boxes to be located as directed. Telephone outlet boxes not used shall be provided with blank cover plates to match switch and receptacle plates.
- B. Each telephone outlet box location requires (1) 1" empty conduit with pull wire unless noted otherwise. Where combination telephone/data outlets are noted on the drawings, provide only one 1" empty conduit with pull wire, unless noted otherwise on the drawings. Telephone conduits shall be stubbed into ceiling void, if entire ceiling void is accessible and not an air return plenum. Install insulated bushing on end of conduit in ceiling voids. Telephone conduits shall be routed to the telephone terminal board if ceiling void is not accessible, is an air return plenum, or ceiling void is not accessible for full distance to the telephone terminal board. Install insulated bushing on end of conduit at terminal board. Verify conditions of job prior to rough-in.
- C. Provide telephone terminal board and racks as shown on the drawings. Board shall be 3/4" fire resistant plywood sized as required by telephone system supplier, minimum 4' x 4'. Telephone terminal board to be mounted on wall and painted with two coats of fire resistant non-conductive paint, color as selected by Architect.

2.2. DATA OUTLET SYSTEM:

- A. Section 2.2 will only apply if there are data outlets shown on the drawings.
- B. Outlets: All data outlet boxes shall be installed with 4" square, minimum 2 1/8" deep box and trim. Coverplates to be as furnished by contractor unless noted otherwise on the drawings. All data outlet boxes to be located as directed. Data outlet boxes not used shall be provided with blank cover plates to match switch and receptacle plates.
- C. Each data outlet box location requires (1) 1" empty conduit with pull wire unless noted otherwise. Where combination telephone/data outlets are noted on the drawings, provide only one 1" empty conduit with pull wire, unless noted otherwise on the drawings. Data conduits shall be stubbed into ceiling void, if entire ceiling void is accessible and not an air return plenum. Install insulated bushing on end of conduit in ceiling voids. Data conduits shall be routed to the data terminal board if ceiling void is not accessible, is an air return plenum, or ceiling void is not accessible for full distance to the data terminal board. Install insulated bushing on end of conduit at terminal board. Verify conditions of job prior to rough-in.
- D. Provide data terminal racks as shown on the drawings. Unless shown otherwise on the drawings, data terminal racks shall be mounted 24" from wall.

2.3. CATV (TELEVISION) OUTLET SYSTEM

- A. Section 2.3 will only apply if there are CATV outlets shown on the Drawings.
- B. Outlets: All CATV outlet boxes shall be installed with 4" square, minimum 2 1/8" deep box and trim, with separately mounted 20 amp 125 volt duplex grounded receptacle adjacent to CATV outlet. CATV coverplates to be as furnished by CATV system supplier unless noted otherwise on the drawings. All floor outlets shall be adjustable water-tight floor box, per Section 26 05 30. All CATV outlet boxes to be located as directed. CATV outlet boxes not used shall be provided with blank cover plates to match switch and receptacle plates.
- C. Each CATV outlet box location requires (1) 1" empty conduit with pull wire unless noted otherwise. CATV conduits shall be stubbed into ceiling void, if entire ceiling void is accessible and not an air return plenum. Install insulated bushing on end of conduit in ceiling voids. CATV conduits shall be routed to the CATV terminal board if ceiling void is not accessible, is an air return plenum, or ceiling void is not accessible for full distance to the CATV terminal board. Install insulated bushing on end of conduit at terminal board. Verify conditions of job prior to rough-in.

PART 3 – EXECUTION

- A. Provide and install cables in all Communication Systems conduits. Provide tags on all cables to indicate termination of wire or conduit.
- B. Provide and install pull boxes at all locations as required.
- C. Provide and install conduit sleeves thru floors and walls as required for the system provider. Vertical conduits/sleeves through closets floors shall terminate not less than 3-inches above the floor and not less than 3-inches below the ceiling of the floor below.
- D. All conduit ends shall be equipped with non-metallic insulated bushings.

- E. Terminate conduit runs to/from the associated telephone, data, or CATV backboard in a closet or designated space at the top or bottom of the backboard. Conduits shall enter closets next to the wall and be flush with the backboard.
- F. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.
- G. All empty conduits located in equipment closets or on backboards shall be sealed with a standard non-hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.
- H. Conduit runs shall contain no more than four quarter turns (90 degree bends) between pull boxes/backboards.

END OF SECTION 27 30 00

SECTION 27 10 00 – BUILDING DATA COMMUNICATION CABLING

This document is the specification for the installation of Structured Cabling Systems at Sedgwick County Adult Detention Facility. The data part is suitable for the provision of high speed Ethernet communications for individual buildings. The principle use of this practice is for the construction of new building, major renovations, or additions to cable plant.

PART 1 – GENERAL

1.1 General Scope

- A. The practice basically follows the relevant EIA, TIA, CSA standards and architectures for commercial buildings. As such, it is focused on the facilities required within a building not the inter-building facilities that are required to ensure a comprehensive County wide network.

The practice aims to ensure a cabling system that will give a predictable, consistent and flexible subsystem with a substantial lifetime for the applications that The Owner needs. It specifies Cat 6 cable for the horizontal UTP copper systems, CommScope is the Approved Manufacturer. It will be noted that for telecommunications rooms, there is single vendor approach for the piece parts such as racks, power distribution units and cable management subsystems. This is done for consistency to make it easier for technicians to service and expand the facilities in those rooms.

- 1. This document specifies the requirements for the installation of all horizontal UTP cabling and all copper cabling to support voice and data applications in a new or renovated space.
 - 2. The contractor or his cabling sub-contractor shall supply and install a complete telecommunications cabling system based on a physical star wiring topology that is designed in accordance with practices recommended by the Building Industry Services International (BICSI) organization. Furthermore, the contractor or cabling sub-contractor shall include all communication outlets, terminating hardware and selected connectivity devices as outlined in this specification.
 - 3. It is the responsibility of the contractor or cabling sub-contractor to report any errors and/or omissions in this specification prior to their bids.
- B. Inquiries Bidders who find discrepancies or omissions in this specification, or who have any doubt as to the meaning or intent of any part of this specification, shall direct their questions or other inquiries by email or facsimile to the Owner or Architect.

PART 2 - PRODUCTS

2.1 PRODUCT AND INSTALLATION STANDARDS

- A. The equipment, material and installation shall conform to the latest version of the applicable codes, standards and regulations of authorities having jurisdiction.
- B. All components supplied and/or installed will support current applications and any future application introduced by recognized standards or user forums that use EIA/TIA 568 component and link/channel specifications for cabling.

- C. The specifications detailed in this document are accompanied by EIA/TIA and/or CSA requirements both for product and installation practices. The following are communications standards documents that must be adhered to:

Standard	Title
ANSI/TIA-568-C.0	Generic Telecommunications Cabling for Customer Premises
ANSI/TIA-568-C.1	Commercial Building Telecommunications Cabling Standard
ANSI/TIA-568-C.2	Balanced Twisted-Pair Telecommunication Cabling Components Standard
ANSI/TIA-568-C.3	Optical Fiber Cabling Components Standard
ANSI/TIA-569-A	Commercial Building Standard for Telecommunications Pathways and Spaces
ANSI/EIA/TIA-606(A)	Administration Standard for the Telecommunications Infrastructure of Commercial Buildings Product and Installation Specifications For Building Data Communication Cabling 5
ANSI/EIA/TIA-607(A)	Commercial Building Grounding and Bonding Requirements for Telecommunications
ANSI/EIA/TIA-598	Color Coding of Fiber Optic Cables
ANSI/EIA/TIA-455	Test Procedures For Fiber Optics, Cables and Transistors
ANSI/EIA/TIA-604-3	FOCIS 3 Fiber Optic Connector Intermatability Standard
ANSI/ICEA-S-83-596	Fiber Optic Premises Distribution Cable
ANSI/CEA S-83-640	Fiber Optic Outside Plant Communications Cable
ASNI/NECA/BICSE-568	Standard for Installing Commercial Building

PART 3 - PRODUCT SPECIFICATIONS

3.1 General Conditions

- A. This document specifies that the horizontal structured cabling system shall be a single manufacturer end-to-end solution. Manufacturer shall be CommScope – (MEDIA6 400 MHZ) Category 6 (Plenum Rated) See appendices for examples of vendor product list and part numbers. It is recommended to consult vendors on current product offerings and Installation Specifications For Building Data Communication Cabling 6.
- B. The Cat 6 end-to-end system solution shall meet or exceed 400MHz in the channel. Third party test results shall be required such as ETL test results. In house manufacturer test results are not acceptable.
- C. Products installed must meet or exceed all local, provincial and federal building, fire, health, safety and electrical codes.
- D. The contractor or his cabling sub-contractor is responsible for complete storage, handling, delivery, and installation of all materials used in the performance of the work.

- E. The cabling contractor is responsible for keeping the workplace clean, safe and free from debris at all times. All debris must be removed from the site on a daily basis. The costs for cleaning are the responsibility of the cabling contractor.

3.2 Cabling Support Structure

- A. The cabling contractor is to supply and install cable support system and any other miscellaneous hardware required for supporting all horizontal cabling where conduit or cable tray has not been provided. All horizontal cabling must be supported at 48" intervals.
- B. Where required by local codes all cabling shall be installed in metallic EMT conduit.
- C. Communications Cabling Category 6 Horizontal Data Cable
 - 1. The horizontal data cabling shall be solid copper, unshielded twisted pair (UTP), 4-pair, 23 AWG, CMP rated (FT6) or CMR rated (FT4), Category 6 cable as applicable. Acceptable cables are CommScope (MEDIA6 400MHZ) Category 6 (Plenum Rated)
 - 2. The cable shall be tested and characterized to 400 MHz and have a positive PSACR above 250 MHz. It shall also be UL listed.
 - 3. The jacket shall be printed with a 1000' to 0' marking system and/or 333 meters to 0 meters system.
- D. Work Area Outlet Solutions Category 6 Modular Jacks
 - 1. Horizontal UTP Category 6 data cabling to be terminated at the workstation shall be terminated with modular 8 position, 8 wire RJ45 connector; Commscope. Modules are to be wired as per T568A. Modular data jacks shall be in color as approved by owner except when used for wireless applications in which case they shall be orange in color.
 - 2. The approved horizontal UTP Category 6 voice cabling to be terminated at the workstation shall be terminated with modular 8 position, 8 wire RJ45 connector. Panduit Modules are to be wired as per T568B. Modular voice jacks shall be in color. As approved by owner,
 - 3. Modular jacks must meet FCC Part 68 Subpart F; contacts are to be plated with 50 micro inches of gold.
 - 4. Modular jack contacts shall have a minimum of 2500 plug insertions without degradation of electrical or mechanical performance as per the IEC60603-7 specification.
 - 5. Jack termination shall utilize a paired termination sequence. Maintain untwist to a maximum of ½ inch during termination. Leave one (1) foot or thirty (30) centimeters of cable slack in the ceiling above each work area outlet location. If the cable is installed in conduit leave one (1) foot or thirty (30) centimeters of cable slack in the closest pull box and or cable tray.
 - 6. Patch cords shall be stranded Category 6 and meet or exceed FCC Part 68 and IEC 60603-7 specifications. The plug shall have contacts plated with 50 micro inches of gold for improved durability and have a minimum of 2500 plug insertions without degradation of electrical or mechanical performance.
 - 7. The patch cord shall be blue in color and shall be ten (10) feet or three (3) meters in length.

8. Patch cords shall be manufacturer assembled and verified. Manufacturer is CommScope, Flush Mounted Faceplates
9. The horizontal UTP cabling shall be terminated at the workstation on a flush mounted wall plate. Each faceplate shall be 4 or 6 ports on a single gang to allow for future growth. All unused ports will have blank modules installed.
10. Faceplates shall be UL listed and CSA Certified. Furniture Faceplates
11. Horizontal UTP cabling terminated at each workstation in systems furniture shall use a four-port faceplate. All unused ports shall be filled in with blank inserts. Cables routed from each workstation to cable rack in "IT" Room.

E. Telecommunications room termination solutions

1. Horizontal Data Cable Terminations - All data Cat 6 horizontal UTP cabling shall be terminated on RJ45 modular jacks and connected to modular rack mount patch panels. The modular patch panels shall be mounted in an Contractor provided standard 19" rack.
2. Modular patch panels (By contractor) shall be 24 or 48 port modular panels and shall be black in color. RJ45 modular jacks shall be used to connect to modular patch panels. Patch Panels shall be CommScope UNP610 Series.
3. Leave ten (10) feet and or three (3) meters of slack in the telecommunications room to allow for future rack relocation if required. Do not store the slack in bundled loops. Cable slack should be stored in an extended loop or in figure eight.
4. Telecom Room Patch Cords - Patch cords shall be stranded Category 6 and meet or exceed FCC Part 68 and IEC 60603-7 specifications. The plug shall have contacts plated with 50 micro inches of gold Product and Installation Specifications For Building Data Communication Cabling 9 for improved durability and have a minimum of 2500 plug insertions without degradation of electrical or mechanical performance.
5. Data patch cords shall be blue in color and shall be seven (7) feet and or two (2) meters in length unless otherwise specified.
6. Approved patch cords shall be manufacturer assembled, tested and verified. Manufacturers is CommScope.

F. Rack and Cable Management System

1. Telecommunication Racks, (Contractor Provided)shall be 19", floor mounted, accommodate a minimum of 45 rack unit space, and have anchor holes in the base.
2. Install racks with a Telecommunications rack ground bar.
3. Vertical Cable Management - Contractor to provide as needed a six inch (6") vertical cable manager is to be provided on each side of the 19" inch rack, except where racks are ganged together. Panduit patch runner PRVF6 (vertical manager), PRD6 (door) or equivalents shall be used.
4. Where racks are ganged together utilize an eight inch (8") PRVF8 (vertical manager), PRD8 (door) or equivalents between the racks. Depending on the number of

horizontal drops where racks are ganged together the twelve inch (12") PRVF12 (vertical manager), PRD12 (door) or equivalent shall be used.

5. The vertical cable manager shall have a metal door that hinges open from the right or left.
6. The vertical cable manager shall have bend radius control built into the manager so as patch cables transition into the manager they are not resting on a sharp edge.
7. Horizontal Cable Management - Contractor shall provide One (1) horizontal cable manager per copper patch panel is to be provided. Managers are to be 1U for 24 port patch panel or 2U for 48 port patch panel.
8. The horizontal cable manager door shall hinge up or down, must have bend radius control built into the slots for patching and transitioning into the vertical managers and must have retaining clips.
9. The color of the horizontal cable manager shall be black. Panduit PatchLink series, WMPFSE, WMPHF2E is an example of an acceptable product.

G. Raceway Solutions

1. All single channel or multi-channel Raceway solutions and accessories installed shall be Panduit, Wiremold, or equivalent.
2. All Raceway shall be installed to the recommended practices of the manufacturer and all applicable electrical codes. All accessories shall have bend radius control built in for communications cabling as per the ANSI/EIA/TIA 569 –A standard.

H. Grounding and Bonding

1. The grounding and bonding of the telecommunications system shall meet all local, provincial and national codes and bylaws.
2. All grounding and bonding shall be installed as per ANSI/EIA/TIA 607(A)
3. A separate ground should be established for the telecommunications system. Where this is not possible the telecommunications system ground shall be tied into the building/electrical ground.
4. A communications ground that is continuous and permanent through all telecommunication rooms must be established.
5. All racks and cabinets must be grounded to the telecommunications grounding system using 6 AWG green insulated stranded copper ground wire. All racks are to be equipped with Panduit TRGB19 telecommunications rack ground bars or equivalent.

I. Fiber Backbone

Cable (Fiber backbone): From Main Telecommunications Closet to all Interconnect locations)

- (a) FIBER: CommScope P/N P-024-DZ-5M-F12AQ. The fiber optic horizontal cable between the Main Telephone Room and the interconnect locations on fiber optic patch panel shall be

twenty four (24) strand 50um laser optimized optical fiber cable. Fiber shall be certified for supporting 10 gigabit transmissions up to 150 meter distances, and be tested per the Differential Delay Mode (DMD) testing standards. Fiber shall have the following minimum optical characteristics: Attenuation of 3.5db @850nm, Bandwidth (OFL) 700mhz.km @ 850nm. The fiber optic horizontal cable shall conform to EIA/TIA 568A for fiber optic cable. Where required, cable shall be classified low smoke and low flame for use in air plenums in accordance with NFPA 70. The fiber cable shall contain twenty four (24) fibers and shall be of continuous manufacture with no factory splices in the fiber. Cable construction shall be tight buffered type. Individual fibers shall be color coded for identification. Cable shall be imprinted with fiber count and aggregate length at regular intervals. All Fiber cabling will be enclosed in an interlocking aluminum armor sheath, with an overall jacket rated suitable for the environment. Jacket colored per the 606 standards for identification of fiber type. Submittal is required to Engineer prior to installation.

(b) Materials used within a given cable shall be compatible with all other materials used in the same cable, when such materials come into intimate contact. All cable components used shall have no adverse affect on optical transmission or on the mechanical integrity characteristics of the fiber placed in the cable. All materials used shall be non-toxic, non-corrosive, and shall present no dermal hazard. The minimum required material components applied to fiber optic cable construction are: color-coded optical fibers, inner jacket, pulling strength members, and outer jacket.

(c) The 50 um multimode fiber shall be solid glass waveguides and shall have a core diameter of 62.5 micrometers, plus or minus 2.5 microns.

(d) The outside diameter of the glass-clad fiber shall be 125 microns, plus or minus one micron, and shall be nominally concentric with the fiber core consistent with the best commercial practice, utilizing DMD testing.

(e) The minimum tensile strength of the fiber short term shall be no less than 600 lbs / 2670 newtons, and long term of 180 lbs / 801 newtons.

(f) The optical fiber shall be coated with a suitable material to preserve the intrinsic high tensile strength of the glass fiber. The coating material shall be readily removable, mechanically or chemically, without damaging the optical fibers when the removal is desired.

J. Miscellaneous

1. Test Equipment - The cabling contractor is to use the Fluke DTX series scanner or equivalent with the latest version of firmware to test the UTP cabling system. All

optical fiber shall be tested with a light source meter. (Details in the testing section of this document.)

2. Spiral Wrap - Cables running from system furniture feed points to the system furniture shall be neatly wrapped with Panduit T50R-C series spiral wrap and or PW series Pan Wrap or equivalent. Cabling contractor to size the spiral wrap accordingly.
3. Fire Stopping - The cabling contractor must supply and install all required fire stopping materials to reestablish the integrity of any and all fire-rated architectural structures and assemblies they have worked on. Mechanical systems consisting of standard conduit, sleeves, cored holes and all horizontal and backbone pathways that penetrate fire-rated barriers shall be fire stopped. The cabling contractor must install an approved fire-stop material recommended by CSA, ULC or UL in accordance with all applicable codes. Intumescent putties and or cementitious materials with a minimum three (3) hour rating shall be used.

PART 4 - INSTALLATION

The approved contractors that have been chosen to participate in this bid shall be a certified installer. The contractor shall have a minimum of five (5) years industry experience and have been trained in the proper installation practices as per ANSI/TIA- 568-C. All contractors shall have manufacturer trained technicians with a minimum of two (2) years installation experience.

A. General Conditions

1. The approved cables and components must be installed and terminated in accordance with the ANSI/TIA-568-C standard. Particular attention must be given to maintaining the integrity of the pair twists, bend radius and ensuring proper distance is kept from fluorescent light fixtures, electrical cables or any other source of EMI.
2. Leave ten (10) feet and or three (3) meters of slack in the telecommunications room to allow for future rack relocation if required. Do not store the slack in bundled loops. Store cable slack in an extended loop or a figure eight. Leave one (1) foot of cable slack in the ceiling above each work area outlet location.
3. The maximum horizontal cable length is not to exceed 90 meters or 295 feet. If the 90 meters or 295 feet constraint cannot be met, the cabling contractor is to notify Owner.
4. All plywood backboard(s) are to be supplied and installed by the contractor unless otherwise noted. All plywood backboards shall be fire retardant.
5. All cables and pathways such as conduits, cable tray or other systems used for communication cable distribution to be run parallel or perpendicular to building lines.
6. To minimize any possibilities of disruption, maintain the minimum clearances from electrical and heat sources when routing cables.
7. Any deviation from the cable routing, outlet and equipment locations shown on drawings must be approved by the consultant and documented on as-built drawings.
8. Avoid scraping, denting, or otherwise damaging cables, before, during or after installation. The cabling contractor, without any additional compensation, shall replace damaged cables.
9. Bush, ream and remove any sharp projections on all conduits prior to installation of communications cables.

B. Horizontal Cable Distribution

1. The contactor or cabling sub-contractor is to supply Panduit Tak-Ty cable ties or equivalent and any other miscellaneous hardware required to support horizontal cabling where conduit or cable tray has not been provided.
2. Pull all cables in a continuous run. No cable splices will be permitted.
3. Leave one (1) foot or thirty (30) centimeters of cable slack in the ceiling above each work area outlet location. If the cable is installed in conduit leave one (1) foot or thirty (30) centimeters of cable slack in the closest pull box and or cable tray.
4. When bundling cables, comply with manufacturer's recommended bundling practices for installation. Ensure that excess pressure is not placed on the cable at any point that may result in the compression or deformation of the cable jacket and internal pair/conductor geometry.
5. Provide blank filler plates for all unused modular jack positions on faceplates.

C. Horizontal Cabling

1. Supply and install horizontal cabling as detailed on communications cabling layout drawings. (Racks are provided by owner and relocated as needed).
2. A typical station cable drop consists of a combination of one (1) horizontal voice and one (1) horizontal data cable unless otherwise noted on the drawings and or otherwise specified.
3. All horizontal data and voice cabling will originate from the telecommunication room out to the designated workstation location in a star topology.

D. Rack and Cable Management System

1. All 19" racks and brackets are to be located as shown on communications cabling layout drawings.
2. All racks are to be anchored securely to the floor.
3. All racks, patch panels, cabinets, metal raceways and data equipment are to be grounded to building ground bus bars using Panduit Network Grounding Systems product or equivalent.

E. Fire Stopping

1. Fire stopping requirements must include prevention of fire from passing through a barrier. These seals are required to maintain safety and security within the clients' premises.
2. The contractor must re-establish the integrity of any and all fire-rated architectural structures and assemblies they have worked on.

F. Labeling

1. All labels shall be Panduit Identification or equivalent Products for voice and data structure cabling systems.

2. Cable labels shall be of self-laminating vinyl construction with a white printing area and a clear tail that self laminates the printed area when wrapped around a cable. The clear area should be of sufficient length to wrap around the cable at least one and one-half times and be installed within 2" of the termination point of the cable, patch cord or pigtail.
3. All adhesive cable labels shall meet the legibility, defacement, and adhesion requirements specified in UL 969 (Ref. D-16). In addition the labels shall meet the general exposure requirements in UL 969 for indoor use.
4. All cable labels shall be compliant with the TIA/EIA-606(A) Section 6.2.2 Cable Labeling, Section 6.2.4 Termination Hardware Labeling, and Section 6.2.6 Termination Position Labeling.
5. All patch panel and BIX/110 block labels are to be mechanically printed and are to follow the guidelines in CSA-T528-93 for Color Coding of Termination Fields.
6. Label all cabling in accordance with CSA-528 specifications. One label should be attached to the front of the workstation faceplate, one to the front of the patch panel, and one at each end of the cable.
7. All labels must be mechanically printed. Hand written labels are not permitted.
8. All intra-building and inter-building backbone cables for voice and data shall be labeled. Labeling shall include destination (building) to and from at each end.
9. The horizontal cables shall be labeled in the format D-floor#-room#-cable#. The per room cable numbers shall be sequential beginning at 1.

Example: D03-038-2 represents a second data cable to room 038 of the third floor.

Example: D11-099-5 represents a fifth data cable to room 099 of the 11th floor.

G. Testing

1. The cabling contractor is to use the Fluke DTX series or equivalent with the latest version of firmware to test the UTP cabling system. A light source and power meter will be used to for all fiber optic cables. The cabling contractor must ensure that all cabling is tested in accordance to the proposed specifications of the category installed.
2. Upon completion of testing by the cabling contractor, a Owners representative may choose to witness up to 10% of the cables being tested.
3. All deficiencies must be corrected before the Project Manager will provide a certificate to release the holdback on the project.
4. Category 6 field test parameters shall be. Testing of all 4 pairs is to include but not be limited to the following:
 - 1) Wire Map
 - 2) Insertion Loss
 - 3) Equal Level Far End Cross Talk (ELFEXT)
 - 4) Power sum equal level far end cross talk (PSELFEXT)
 - 5) Delay Skew
 - 6) Power sum attenuation to crosstalk ratio (PSACR)
 - 7) Near end cross talk (NEXT)

- 8) Propagation Delay
- 9) Cable length
- 10) Power sum near end cross talk (PSNEXT)
- 11) Return Loss

5. Fiber Optic Testing : The Contractor shall test, verify, and document that the installed fiber optic cable meets all the essential cable parameters specified by EIA/TIA 455A, and the cable manufacturer. The tests shall be accomplished between each outlet drop and the associated telecommunications closet for multimode fiber.

- (1) The optic fiber shall be optimized for lightwave transmission at nominal wavelengths of 850 nm and 1300 nm, plus or minus 30 nm. Numerical aperture for each fiber shall be a minimum of 0.275.
- (2) Attenuation requirements are as follows:
 - 3.0 dB/km or less @ 850 nm
 - 1.0 dB/km or less @ 1300 nm
- (3) The attenuation measurement method shall be in accordance with EIA/TIA 455A, FOTP-46 or FOTP-53.
- (4) The bandwidth measurement shall be in accordance with EIA/TIA 455A, FOTP-30 frequency domain or FOTP-51 time domain.
- (5) Minimum bandwidth requirements (3dB) are as follows:
 - 700 Mhz-km @ 850 nm
 - 500 Mhz-km @ 1300 nm
- (6) The minimum tensile strength of the fiber after primary protective coating shall be at least than 600 lbs.

- 6. A tester with the most recent version of its software and firmware must perform all tests in accordance to ANSI/EIA/TIA TSB-67. The nominal velocity of propagation (NVP) must be set specific to each cable manufacturer before testing. Portable testers to be calibrated on a minimum annual basis. Fluke DTX or equivalent shall be used.
- 7. Test patch cords for the tester must be designed and approved for testing by the manufacturer. Field assembled patch cords are not acceptable.
- 8. Test each strand of fiber with a Power Meter / Light Source combination operating at wavelengths of 850 nm and 1300 nm for multimode fibers and 1310 nm and 1550 nm for single mode fibers. Perform these tests in both directions. These tests shall be completed after cable installation, splicing and connectors are installed. Provide test results in soft copy to the Owner representative for the project.
- 9. All cable faults must be corrected. Splicing of any cables will not be permitted, for any reason, unless prior authorization if received in writing by Sedgwick County.

PART 5 - DOCUMENTATION

5.1 "As built" drawings

- A. The contractor or cabling sub-contractor is required to provide as-built drawings of the cable installation. This shall include the pathway of the cables from the telecommunications rooms to the workstation. The as-built drawings shall also include all

additional cabling installed during the project. The contractor or cabling sub-contractor shall provide the as-built drawings to Owner within 7 business days of the completion of the project.

5.2 Cable test results

- A. The contractor or cabling sub-contractor shall provide all test results in hard and soft copy to Owner. The electronically supplied test results shall be in the proper tester format. Test results shall include all voice and data horizontal cables and all voice and data backbone cables. The hard copy report shall indicate for each cable, when it was tested successfully and the signature of the technician that performed the test. The entire report must be signed by an authorized person for the installing contractor at the end of the project.

PART 6 - WARRANTY

The installing sub-contractor must provide the owner with a 20 year product warranty and a minimum one (1) year labor warranty.

SECTION 28 31 00– FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.1 SCOPE & RELATED DOCUMENTS

- A. The work covered by this section of the specifications includes the furnishing and installation of all equipment & materials associated with the Fire Alarm System as shown on the drawings and as herein specified. This system may include, but is not limited to:
 - 1. 2.1 Fire Alarm Graphic Workstation Screen Edit
- B. The requirements of the conditions of the Contract, Supplementary Conditions, and General Requirements apply to the work specified in this section.
- C. The work covered by this section of the specifications shall be coordinated with the related work as specified in each of the sub-system portions of this section and elsewhere in this specification.

1.2 QUALITY ASSURANCE

- A. Product Qualifications
 - 1. All control equipment for each system (i.e. Synchronized Clocks etc.) shall be the product of a single manufacturer.
 - 2. All control equipment must have transient protection to comply with UL864 requirements.
- B. Fire Alarm System manufacturer/supplier.
- C. Upon completion of the installation, the Fire Alarm Supplier, whether manufacturer/supplier or integrator/supplier shall send factory trained personnel to perform all necessary final electrical tests and adjustments at the jobsite and who shall then submit a "Letter of Certification" stating that: The system was tested and functions properly and that the system conforms to the requirements of these specifications. Tests to be performed and reports to be submitted shall be as specified hereinafter. The system manufacturer shall notify the Owners' Representative at least one week prior to final testing. All test reports shall be certified and sent to the Owners' Representative for review. Tests shall be performed in the presence of the Owners' Representative.
- D. The fact that a manufacturer is an APPROVED MANUFACTURER does not diminish their responsibility to meet all the criteria as directed in this specification including but not limited to submittal approvals.
- E. For the basis of establishing a minimum standard of criteria for the required equipment, the specifications refer to Simplex equipment and model numbers.
- F. Substitutions of products proposed to be bid other than those specified herein will be considered only when the following requirements have been met:
 - 1. A COMPLETE LIST of such substituted products, with drawings and data sheets, shall be submitted to and approved by the electrical consulting engineer, not less than fifteen (15) calendar days prior to scheduled date of opening of bids.

2. IT SHALL CONFORM to the standards herein and the manufacturer must supply proof of having produced similar equipment for at least ten years with a written history of system now rendering satisfactory service provided. Substitute equipment and its capabilities must be a standard part of that systems current product line and must meet or exceed the capabilities of the equipment specified.

1.3 SUBMITTALS:

- A. Within sixty days after contract award, and prior to the purchase of any equipment, submit for review by the Owners' Representative, seven copies each of the following:
 1. A complete list of all materials including all components and associated technical information of each piece of equipment proposed.
 2. Complete project specific system circuit diagrams and block diagrams indicating how each and all components are related, how they are interconnected and a point to point wiring diagram. Each wiring diagram shall be supplemented by a sequence of operation.
 3. Circuit diagrams, block diagrams, interconnecting and point to point diagrams shall be "signed off" by technically qualified full time personnel of the system manufacturer.
- B. Complete electrical characteristics and physical dimensions shall be provided for individual systems components group mounted. Block diagrams, submitted for approval shall be for this specific system; standard manufacturer's diagram indicating options are not acceptable.
- C. The engineer reserves the right to require a sample of any equipment submitted for approval or to require a demonstration of any specific system. All items submitted for approval shall be returned. All payments for freight transport shall be paid by the Electrical Contractor.
- D. Each individual submittal item for materials and equipment shall be marked to show specification section and paragraph number which pertains to the item.
- E. Prior to submitting shop drawings, review submittal for compliance with the contract documents and place a stamp or other confirmation thereon which states that the submittal complies with contract requirements. Submittals without such verification will be returned disapproved without review.
- F. Before final acceptance of work, submit five copies of a composite "Operating and Instructions and Shop Maintenance Manual". Each Manual shall be in three ring binder(s) and shall contain, but not be limited to:
 1. Statement of the guarantee including date of termination and name and phone number of the technician to be called in the event of equipment failure. This technician shall be not further than fifty miles from the jobsite. The same location shall stock a full compliment of parts and offer services on all equipment to be furnished.
 2. Individual project specific factory issued manuals containing all technical information on each piece of equipment installed. Operational instructions shall be used in lieu of the required technical manuals.
 3. Copy of final tests and all reports.
 4. As built conduit layout diagrams including wire color code and/or tag number.
 5. Complete as built wiring diagrams and sequence of operations for each diagram. Diagrams shall be "signed off" by a full time technically qualified manufacturer's employee.
 6. Detailed catalog data on all installed system components.

1.4 RECORD DRAWINGS:

- A. At the time of final inspection, provide three sets of complete data on the equipment used in this project. This data shall be in bound and PDF form and shall include all shop drawings required for this project.
- B. RECORD drawings for the system shall include layout drawings of each item of equipment identified and cross referenced with specification data sheet of equipment.
- C. All record drawings shall include "as built" system interconnection diagrams with major components identified and number and type of interconnecting conductors.
- D. Maintenance and operating instructions on all systems.
- E. Certification from the system manufacturer that systems are installed in accordance with manufacturer's recommendations and are functioning correctly at the time of final inspection.

1.5 SYSTEMS OPERATION TEST:

- A. Prior to the time of final inspection, the Electrical Contractor and Fire Alarm Manufacturer shall jointly conduct an operational test of each system comprising the total system to determine full compliance with the specifications and the applicable drawings. A technician in the full time employee of the manufacturer of each system shall be present to assist in the test. The Electrical Contractor shall provide all personnel, equipment, instrumentation and communication equipment and shall include all costs of testing in the base contract.
- B. The manufacturer's technical representative shall certify in writing that the systems are installed in compliance with the manufacturer's recommendations, comply with the requirements of the contract documents and are operating correctly. These written certifications shall be submitted to the Architect and shall signify that the system is operational and ready for final acceptance testing by the Architects Representative.

1.6 OPERATION INSTRUCTIONS:

- A. The Fire Alarm Manufacturer shall include in the base contract all costs required to train the Owners' operating and maintenance personnel in the use and maintenance of systems provided under this Division of the specifications. Training sessions shall be conducted by instructors certified in writing by the manufacturer of the specific system. Sessions shall be conducted for not less than (1) one hour period during normal working hours (i.e. Monday through Friday, 8:00 a.m. to 5:00 p.m.) Training session schedules shall conform to the requirements of the Owner for approval not less than two weeks prior to the training session.
 - 1. Closed Circuit Video Equipment (CCVE) sub systems operation, each master controller, cameras and monitors, switchers and pant-tilt zoom controllers – 4 hours.

1.7 DESCRIPTION OF WORK:

- A. GENERAL
 - 1. Furnish and install required equipment and screen edits to existing system as described herein and as shown on the plans; to be wired, connected, and left in first class operating condition. Include sufficient Fire Alarm devices, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system shall be provided in this contract.

2. The system shall be capable of on site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory. Loss of primary and secondary power shall not erase the instructions stored in memory.
 3. Full flexibility for selective input/output control functions based on ANDing, ORing, NOTing, timing, and special coded operations shall also be incorporated in the resident software programming of the system. Inputs and Outputs shall have the ability to be prioritized such that an input or series of inputs of a higher priority will take precedence over events controlled by lower priority inputs. Conversely lower priority events may not override higher priority events. Priorities of points may be automatically changed on a timed basis.
- B. THE WORK under this division of the specification shall consist of, but shall not be limited to, the installation of the following systems:
1. 2.01 Program and screen editing of Control/Sub-Control Equipment, 4120/4100u/4100ES Network System including but not limited to Workstation Units, 4100 Status Command Centers, 4100u Network Nodes and related control equipment.
- C. Furnish and install all equipment, wiring, conduit, standard and special wall boxes and cabinets to make a complete and functioning system as hereinafter specified and shown on the plans. It shall be the responsibility of the Electrical Contractor to provide all equipment and materials compatible to the system supplied. All equipment shall be located as shown on the drawings. Any equipment not specifically mentioned in this specification or not shown on the drawings, but required for the operation of a completely functional system shall be furnished and installed. It shall be the responsibility of the Electrical Contractor to coordinate and oversee all his Division 16 sub-Suppliers to insure interfacing between trades is accomplished in a timely and professional manner. It shall be the responsibility of the Electrical Contractor to work with other trades in a timely and professional manner to insure proper installation of the herein specified systems.
- D. Electronic Systems Supplier shall provide all materials, equipment and supervision to install, adjust and check out the total system as well as one 100% test of the system at completion of the project.
- E. The Electrical Contractor shall be responsible for the labor, installation, equipment, wiring and termination of all devices.

PART 2 - EQUIPMENT

2.1 CONTROL/SUB-CONTROL EQUIPMENT

- A. GRAPHIC WORKSTATION SCREEN EDIT:
1. The existing Graphics control screens shall be edited to reflect remodel and additions to the facility and shall operate by receiving system events and displaying specified graphic representations of the conditions of zone(s).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide and install the system in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendations.
- B. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate Sub-Suppliers.
- C. The Electrical Contractor shall clean all dirt and debris from the inside and the outside of the Electronic Security equipment after completion of the installation.
- D. The manufacturer's authorized representative shall provide on-site supervision of installation.

3.2 TESTING

- A. Upon completion, the Electrical Contractor shall so certify in writing to the Owner and General Contractor. All junction boxes shall be labeled Fire Alarm.. Wiring color codes and tagging system shall be maintained throughout the installation. Match existing if possible.
- B. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate Sub-Suppliers.
- C. The Electrical Contractor shall provide all necessary instruments and special apparatus to conduct any test on the wiring that may be required to insure the system is free of all improper grounds and short circuits, and that all feeders are properly balanced. System as installed shall be checked for quality, capacity, and completeness, and conform with full requirements and intent of plans and specifications.

3.3 GENERAL:

- A. The Electrical Contractor shall furnish and install all wiring, conduit, junction boxes and outlet boxes required for the installation of a complete system. Rigid conduit shall be utilized in Security Areas and EMT conduit in Administrative Areas.
- B. All systems wiring shall be installed in accordance with the latest edition of the National Electrical Code (NEC).
- C. Wiring between 4120/4100u Network system and status command centers in Sub-Control areas as well as wiring to network node cabinets shall be as designated by the control system manufacturer.
- D. All wiring shall be terminated by the Electrical Contractor, done in a neat and professional manner, and shall be laced with appropriate nylon ties and labeled at both ends. Each circuit shall be labeled with its circuit number.
- E. All control wiring systems shall use solid copper conductors. Stranded conductors shall be acceptable where all terminations can be made to lugs. Where stranded conductors are used all terminations shall be made with crimp type lug, correctly sized for termination, and applied to conductor with crimping tool intended for use with the lug used.

- F. All wiring systems shall be labeled and color coded with labeling and coding shown on shop drawings. White conductors shall be used only for neutral conductors, green only for grounding conductors. All conductors within junction boxes, pull boxes and equipment enclosures shall be grouped and laced with nylon tie straps with identification tab.
- G. Cables shall be installed so as not to restrict the opening of the panels for service. Wiring on the underside of the panels shall be grouped and laced with nylon tie straps with a maximum spacing of one inch (1"). Straps will be placed within ½" on each side of all bundle breakouts. Wiring will be supported on intervals not exceeding four inches.
- H. Refer to Division 16 General specifications and all Division 16700 specific sub-sections for additional wiring and installation information.

3.4 SERVICE AND TESTING

- A. The manufacturer shall provide supervision of the project during installation, supervision of final connections and testing of all devices, demonstrate system operation following check out in the presence of the architect, engineer and owner, and shall after completion of the project and acceptance by the same, provide any service incidental to the proper performance of the system during the guarantee period. After the guarantee period, the manufacturer shall provide upon request and at standard rates, the service necessary for the future proper performance of this system. To provide this service, the manufacturer shall have an intrastate service organization consisting of direct full time employees under the supervision of a qualified service manager. Service availability shall be local. The prime function of this organization shall be prompt, efficient service.

3.5 WARRANTY AND MAINTENANCE OBLIGATIONS:

- A. After all work herein specified has been completed, the Electrical Contractor and Fire Alarm Supplier shall jointly warrant the completed system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of the completed and certified test or from the date of first beneficial use whichever occurs first. Such defects shall apply to faulty materials or workmanship. In the event of the development of said defects, the Electrical Contractor and Fire Alarm Supplier shall remedy the failure at his own expense within a reasonable time after notice.
- B. The equipment manufacturer shall provide to the owner a maintenance contract, as described below, and additionally as indicated in prior section of this specification, proposal to provide a minimum of:
 - 1. 24 hours/day, 7 days per week service on all equipment.
 - 2. Four (4) hour response which shall be defined as service personnel being on-site within 4 hours after service call is initiated by owner.
 - 3. All Sub-Control and network node units are fully warranted, including replacement of any failed parts.
 - 4. Battery replacement shall be included for all modified panels new and existing..
 - 5. In new addition two (2) Test and Inspections per year on the fire alarm system. These Test & Inspections shall be conducted during 3rd shift.
 - 6. Peripheral device replacement costs are not covered after the first year warranty.

SECTION 31 10 00 - SITE CLEARING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Clearing and protection of vegetation.
- B. Removal of existing debris.
- C. Topsoil stripping.
- D. Grubbing.
- E. Removing above-grade improvements.
- F. Removing below-grade improvements.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- C. Section 01 57 13 - Temporary Erosion and Sediment Control.
- D. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.
- E. Section 31 20 00 - EARTH MOVING - Topsoil removal.

1.03 QUALITY ASSURANCE

- A. Clearing Firm: Company specializing in the type of work required.
 - 1. Minimum of three years of documented experience.

PART 2 PRODUCTS -- NOT USED**PART 3 EXECUTION****3.01 SITE CLEARING**

- A. Comply with other requirements specified in Section 01 70 00.
- B. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures, specified in 01 57 13 - Temporary Erosion and Sediment Control are in place.

3.03 EXISTING UTILITIES AND BUILT ELEMENTS

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Protect existing structures and other elements that are not to be removed.

3.04 PROTECTION OF EXISTING IMPROVEMENTS

- A. Provide protections necessary to prevent damage to existing improvements indicated to remain in place.
- B. Protect improvements on adjoining properties and on site.
- C. Restore damaged improvements to their original condition, as acceptable to parties having jurisdiction.

3.05 VEGETATION

- A. Scope: Remove trees, shrubs, brush, and stumps in areas to be covered by building structure, paving, playing fields, lawns, planting beds and where indicated on the drawings.
- B. Do not begin clearing until vegetation to be relocated has been removed.
- C. Do not remove or damage vegetation beyond the following limits:
 - 1. 30 feet (9 m) outside the building perimeter.
 - 2. 10 feet (3.1 m) each side of surface walkways, patios, surface parking, and utility lines less than 12 inches (305 mm) in diameter.
 - 3. 15 feet (4.6 m) each side of roadway curbs and main utility trenches.
 - 4. 25 feet (7.5 m) outside perimeter of pervious paving areas that must not be compacted by construction traffic.
 - 5. Exception: Specific trees and vegetation indicated on drawings to be removed.
 - 6. Exception: Areas indicated on drawings where cut and fill occur.
- D. Install substantial, highly visible fences at least 3 feet (1 m) high to prevent inadvertent damage to vegetation to remain:
 - 1. At vegetation removal limits.
 - 2. Around trees to remain within vegetation removal limits; locate no closer to tree than at the drip line.
 - 3. Around other vegetation to remain within vegetation removal limits.
 - 4. See Section 01 50 00 for fence construction requirements.
- E. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum disturbance of the subsoil.
- F. Vegetation Removed: Do not burn, bury, landfill, or leave on site, except as indicated.
 - 1. Chip, grind, crush, or shred vegetation for mulching, composting, or other purposes; preference should be given to on-site uses.
 - 2. Tree and Shrub Roots and Stumps: Completely remove stumps, root balls, and roots 2 inch (50 mm) diameter and larger.
 - 3. Fill holes left by removal of stumps and roots, using suitable fill material, with top surface neat in appearance and smooth enough not to constitute a hazard to pedestrians.
- G. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace or employ experienced nursery man to repair damages to trees and shrubs at no cost to Owner.
 - 1. Replace trees which cannot be repaired and restored to full-growth status, as determined by a nursery.
 - 2. Provide protection for roots over 1 1/2 inch (38 mm) diameter cut during construction operations. Coat cut faces with an emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.

3.06 DEBRIS

- A. Remove debris, junk, and trash from site and dispose of in a legal manner.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 31 20 00 - EARTH MOVING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Removal and stockpiling of topsoil.
- B. Rough grading, site preparation, excavation, fill and backfill for the site for site structures, building pads, utilities, and paving.
- C. Replacement of topsoil and finish grading .
- D. Work of all trades shall comply with this section.
- E. Work includes a final blading and shaping of the grades on the site. To be completed near the end of the project. Site to be free of weeds, ruts, trash, debris.

1.02 RELATED REQUIREMENTS

- A. Geotechnical Study - Geotechnical Engineering Report.
- B. Section 01 57 13 - Temporary Erosion and Sediment Control.
- C. Section 31 10 00 - Site Clearing.

1.03 DEFINITIONS

- A. Backfill: Soil material placed back in an excavated area up to the original soil level or grade.
- B. Excavation: Cutting and removing soil materials to provide for construction of utilities, building elements, paving, site improvements, etc.
- C. Fill: Soil material placed above an original soil level or grade.
- D. Finish Grading: Grading, spreading, adjusting and raking soil to fine accuracy within 1 inch (25 mm) of indicated grade, level or plane. Allow 1 inch (25 mm) for sod where indicated.
- E. Rough Grading: Spreading and adjusting soil levels and planes to uniform slopes, within 3 inch (76 mm) of indicated grade, level and plane.
- F. Site: Land area where work for this project is indicated.
- G. Soil Engineer: Soil testing agency responsible for field quality control of earthwork.
- H. Utilities: Underground piping and services for buildings and site improvements.
- I. Waste: Debris, removed and demolished materials, unsatisfactory and excess soils materials resulting from site preparation, demolition work, utility work and construction operations.

1.04 REFERENCE STANDARDS

- A. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.
- B. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2015.
- C. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2012.
- D. ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction; 2012.
- E. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2010.
- F. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Test Reports: Secure and submit to Soil Engineer proposed off-site borrow soil samples as needed for evaluation and determination of acceptability for project use.
 - 1. On-site material samples required by Soil Engineer will be obtained by the Soil Engineer.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of experience.
- B. Geotechnical Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.
 - 1. SJCF shall approve laboratory for soil compaction testing.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where indicated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.

1.08 FIELD CONDITIONS

- A. Site Survey: The Owner has a survey of the project site and surrounding areas. A copy of this survey is included in the drawings for information. Background copies of the survey serve as a base for other sitework drawings.
- B. Subgrade Soil Survey: The Owner has a report of the subgrade soils investigation conducted at numerous locations within the building site in year 1996. A copy of this report is bound with these specifications for convenience and information. The data is representative of the test locations. Conditions do vary between test locations and will vary seasonally. The general character of soils and conditions have been used to establish these specifications.
 - 1. Additional exploratory work may be done by Bidders and Contractors at their own expense. Correlate such work with the Owner.
- C. Existing Utilities: Survey shows utility locations as accurately as records permit.
 - 1. Maintain utility services active during construction. Schedule any necessary shut-downs with Owner well in advance of interrupting service.
 - 2. Utility Locator Service: Notify Kansas One-Call System at 1-800-DIG SAFE (1-800-344-7233) before beginning earth moving operations. A notice of two full working days is required.
 - a. Stake and mark additional indicated locations of underground lines before excavating in the area they are indicated. Excavate carefully and when located verify location.
 - b. RECORD on project record site plan all locations; show corrections where discrepancies occur.
 - 3. Repair damage to utilities due to earthwork operations at no added cost to the Owner.
- D. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in 01 57 13 - Temporary Erosion and Sediment Control are in place.
- E. Explosives: Use of explosives not permitted.

F. Protection of Persons and Property:

1. Barricade open excavations occurring as part of this work and post with warning devices.
2. Operate warning lights as recommended by authorities having jurisdiction.
3. Protect structures, utilities, landscape materials, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards occurring during earthwork operations.
4. Perform excavation within drip-line of "trees to remain" by hand, and protect the root systems, of landscape materials which remain, from damage or dry out to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with burlap. Paint root cuts of 1 inch (25 mm) diameter and larger with emulsified asphalt tree paint.

PART 2 PRODUCTS**2.01 SOIL MATERIALS**

- A. Clean low volume change (LVC) material: Soil shall be approved; free of organic material and debris. For fill, backfill and for low volume change zone below slabs on grade:
 1. Granular materials with liquid limit (LL) of less than 45 and plasticity index (PI) of between 5 and 18.
 2. Silty gravel (e.g. AB-3 KDOT).
 3. Excavated soil treated to provide equivalent characteristics as materials above.
- B. For granular leveling bed below slab on grade areas: Clean granular material free from organic material and debris.
 1. Clean, well-graded granular material meeting ASTM D448, #10 material.
- C. For fill and backfill adjacent to foundation and retaining walls where soil contacts only one surface: Clean granular material free from organic material and debris.
 1. Clean, well-graded granular material meeting ASTM C33/C33M #57 or #67 gradation.
- D. Topsoil:
 1. From topsoil stockpile on site.
 2. Clean stripped top soil with organic materials.
 3. Clean sandy loam which is currently supporting vegetation but little if any weeds or sandy loam which is treated to control weed growth.

2.02 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inch (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inch (750 mm) deep; colored as follows:
 1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.

PART 3 EXECUTION**3.01 SITE PREPARATION**

- A. Remove paving, curbs, walks, steps, trees, shrubbery, and other site improvements indicated and necessary for removal to permit construction of the new work shown.
- B. Protect trees, shrubbery and ground cover to remain. Construct barricades. Barricade trees at drip line unless approved otherwise by SJCF.
- C. Remove above ground surface vegetation from areas to be stripped.
- D. Protect and maintain erosion and sedimentation controls during earth moving operations.
- E. Notify utility company to remove and relocate utilities.

3.02 EXCAVATION

- A. General:
 - 1. Excavation is unclassified, and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.
 - 2. Unauthorized excavation consists of removal of material beyond indicated subgrade elevations or dimensions without specific direction of SJCF. Unauthorized excavation, as well as remedial work directed by SJCF shall be at the expense of the Contractor.
 - 3. Under footings, foundation bases, or retaining walls, fill unauthorized excavation with concrete by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation.
 - a. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by SJCF.
 - 4. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by SJCF.
- B. Additional Excavation:
 - 1. When excavation has reached required subgrade elevations, notify SJCF and Soil Engineer who will make an inspection of conditions.
 - 2. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by SJCF.
 - 3. Removal of unsuitable material and its replacement as directed will be paid on basis of contract conditions relative to changes in work.
- C. Stability of Excavations:
 - 1. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
 - 2. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- D. Shoring and Bracing:
 - 1. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition and to comply with local codes and authorities having jurisdiction.
 - 2. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses. Remove as backfill progresses.
- E. Dewatering:
 - 1. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

2. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation soils, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations and into storm sewer.
 3. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water to collecting areas. Do not use trench excavations as temporary drainage ditches.
- F. Material Storage:
1. Stockpile satisfactory excavated materials within site area until required for backfill, fill or dressing. Place, grade and shape stockpiles for proper drainage.
 2. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.
 3. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet (2.5 m); protect from erosion.
- G. Excavation for Structures:
1. Conform to elevations and dimensions shown within a tolerance of plus or minus 1 inch (25 mm), and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
 2. In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.
 3. Do not place concrete until excavation has been inspected and approved.
- H. Excavation for Pavements:
1. Cut surface under pavements to comply with cross-sections, elevations and grades as shown.
- I. Excavation for Trenches:
1. Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room and shoring, if any. Provide 6 - 9 inch (152 - 228 mm) clearance on both sides of pipe or conduit.
 2. Excavate trenches to depth indicated or required. Carry depth of trenches for piping to establish indicated or proper flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.
 3. Except as otherwise indicated, excavate for exterior water-bearing piping (water, steam, condensate, drainage) so top of piping is not less than 42 inches (1067 mm) below finished grade.
 4. Grade bottoms of trenches to accurate grade, notching under pipe connections to provide solid bearing for entire body of pipe. Pipe may be bedded in granular material which shall surround pipe approximately 6 inches (152 mm) except where dike is specified.
 5. Do not backfill trenches until tests and inspections have been made and backfilling authorized by SJCF. Use care in backfilling to avoid damage or displacement of pipe systems.

3.03 COMPACTION

- A. Roll or tamp using equipment appropriate to conditions under which work is performed. Compact each lift.

- B. Condition soil materials and maintain required moisture content as work proceeds. Rework materials as needed to comply with specifications when in-place work deteriorates or does not comply.
- C. Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.
 - 1. Fill and backfill within building areas, backfill of foundation walls outside building.

LOCATION	SOIL TYPE	MIN. MOISTURE CONTENT	MINIMUM COMPACTION
Below the LVC	On-Site Soil	Wet of Optimum	95% to 100%
Fill below the LVC	LVC per G.E. Report		
LVC	Cohesive	Above Optimum	95% to 100%
	Granular	Workable Moisture	95% to 100%
	Fly Ash Modified	Above Optimum	95% to 100%

- 2. Fill and backfill below pavement areas.

LOCATION	SOIL TYPE	MIN. MOISTURE CONTENT	MINIMUM COMPACTION
Exposed subgrade before fill	On-Site Soil	At or Above Optimum	95% to 100%
Fill	Approved Material	Above Optimum	95% to 100%
Subgrade	Fly Ash Modified	Within 2% of Optimum	98% to 100%
	On-Site Soil	Within 2% of Optimum	98% to 100%
	Granular (AB-3)	Within 2% of Optimum	98% to 100%

- 3. Fill and backfill of utility trenches outside building areas.

LOCATION	SOIL TYPE	MIN. MOISTURE CONTENT	MINIMUM COMPACTION
Fill	On-Site Soil	Above Optimum	90%

- 4. Tables above based on Maximum Dry Density (ASTM D698).

3.04 MOISTURE CONTROL - DENSITY:

- A. Condition and maintain required moisture and density in soil layers and subgrade until subsequent layers or until the floor slab or paving are placed.
- B. Protect excavations against drying or over wetting causing the clay bearing and subgrade to shrink or swell.

3.05 BACKFILL AND FILL

- A. Ground Surface Preparation:
 - 1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface. Strip 6 inch (152 mm) minimum depth of topsoil with root structure and stockpile for top soil dressing and fill.

2. Proof-roll the exposed subgrade soils, in the presence of the Soils Engineer, using a rubber tired vehicle weighing at least 20 tons (18 metric tons) to locate soft or unstable soils.
 3. Scarify, plow or otherwise loosen the top 9 inch (228 mm) of the exposed subgrade following proof-rolling operations and the removal of any identified zones of soft or unstable soils. Pulverize and properly moisture condition the scarified soils prior to compacting.
 4. The specified moisture content of the subgrade soils must be maintained during construction. The moisture content of the subgrade soils shall be evaluated prior to the installation of the granular sub-base below the floor slab.
- B. Fill and Backfill Preparation:
1. Verify that:
 - a. Subgrade and construction below finish grade including, where applicable, drainage system, dampproofing and perimeter insulation are complete.
 - b. Inspection, testing, approval, and recording locations of underground utilities is complete.
 - c. Formwork, trash and debris are removed.
 - d. Permanent or temporary horizontal bracing is in place on walls with one-side ground contact.
 2. Construct five foot long dike in utility trenches outside building in CL & CH soils when no foundation drainage system is provided.
 3. Backfill trenches under floors on-grade up to underfloor granular fill.
- C. Place acceptable conditioned soil material in layers up to required subgrade elevations, for each area classification listed below:
1. Under Slab on Grade Floors
 - a. Minimum 4 inch (101 mm) granular leveling bed over 12 inch (305 mm) minimum LVC soils. Maintain specified moisture content of soils.
 - b. The upper 9 inch (228 mm) of the subgrade below the LVC soils; add water and rework on-site soils to the specified moisture content.
 2. Foundations
 - a. Including foundations, retaining and tunnel walls-where soil contacts both faces use approved materials as outlined under Soil Materials.
 3. Piping, Conduit, Utilities Under Building
 - a. Backfill with approved under floor materials, as specified above.
 4. Piping, Conduit, Utilities Outside Building and Paving
 - a. Excavated materials to bottom of subgrade for paving and to bottom of topsoil otherwise.
 5. Pavement Area
 - a. Minimum 8 inch (203 mm) of modified subgrade or approved material below the pavement. Additional fill shall meet the same fill requirements as the fill for the building pad.
 6. Walks, Pedestrian Paving
 - a. Minimum 1 inch (25 mm) granular leveling bed over on-site soils or approved soils, scarify and compact top 6 inches (150 mm).
 7. Topsoil
 - a. Disturbed areas outside building areas and drives: 4 inch (100 mm)
- D. Placement and Compaction:
1. Place backfill and fill materials in layers not more than 8 inch (203 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inch (102 mm) in loose depth for material compacted by hand-operated tampers.

2. Before compaction, moisten or aerate each layer as necessary to provide required moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification.
 3. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 4. Remove shoring and bracing, and backfill voids with satisfactory materials as work progresses.
 5. Topsoil:
 - a. Place topsoil during dry weather.
 - b. Remove roots, weeds, rocks, and foreign material while spreading.
 - c. Near plants and buildings spread topsoil manually to prevent damage.
 - d. Lightly compact placed topsoil.
- E. Utility Trench Backfill:
1. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
 2. Trenches under Footings: Reference structural drawings for trenches less than 24 inches (609 mm) below bottom of footing. Backfill trenches with approved fill, compacted and moisture controlled, for trenches more than 24 inches (609 mm) under footings unless structural drawings indicate otherwise.
 3. Place backfill and fill materials evenly adjacent to structures, piping or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift.
 4. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.06 GRADING

- A. Uniformly grade areas within limits of grading including adjacent transition areas. Smooth surface within specified (defined) tolerances. Construct with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.
- B. Grade areas adjacent to building to drain away from structures and to prevent ponding.
- C. Finish grade surfaces free from irregular surface changes, rake smooth and leave clean, free of clods.
- D. Walks: Shape subgrade surface to line, grade and cross-section, with finish surface not more than 1/2 inch (12 mm) above or below required elevation. Finish grade topsoil 1 inch (25 mm) below abutting walk surface.
- E. Curbs and Pavements: Shape subgrade surface to line, grade and cross-section, with surface not more than 1/2 inch (12 mm) above or below required subgrade elevation. Earth 1 inch (25 mm) below abutting construction.
- F. Surface Under Building Slabs, Steps, etc.: Subgrade smooth and even, free of voids, compacted as specified within a tolerance of 1/2 inch (12 mm) above or below required elevation.

3.07 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Responsibility of Soil Engineer and/or Inspecting Personnel:
 1. Evaluate materials for compaction by performing moisture content and density tests prior to placement and compaction work.

2. Inspect subgrade and excavations for foundations, evaluate and, if necessary, test to assure that the foundation soils provide proper capacities for the structural loading.
 3. Perform tests during construction operations as required to assure compliance of all subgrade, fill and backfill.
 4. Reject material which in his opinion will be detrimental to fill and/or backfill.
 5. Require any extent of manipulation of material to meet specifications.
 6. Suspend placement of new material until in-place materials are properly compacted.
 7. Require rework of in-place material if work interruptions or weather conditions cause deterioration below acceptable limits.
 8. Testing (optimum moisture content/maximum dry density) performed in accordance with ASTM D1556/D1556M (sand cone method) or ASTM D6938 (nuclear method) to verify that specified conditions have been met.
 9. When below specification results occur, Contractor shall recompact non complying soils and retest as needed until specifications are met.
 10. Submit to SJCF and Contractor two copies of soil compaction test reports and a report certifying that design requirements and specifications have been fulfilled in the construction work.
- C. Responsibility of Contractor:
1. When the testing laboratory is not on the project on a full-time basis, notify testing laboratory whenever fill or backfill is to be placed, so that testing agency can perform tests on subgrade and/or fill as each lift is being placed.
 2. Notify testing laboratory of his need for testing services with an 18-hour notice whenever possible or as otherwise arranged to accommodate construction sequencing.
 3. Approval of foundation bearing soils is to be obtained from the soils engineer prior to placement of reinforcing steel.
 4. Notify soils engineer for his re-evaluation if rain occurs after foundation bearing soils have been approved, but before concrete placement.
- D. Soil Compaction Testing to be completed for the following:
1. Fill and backfill under building construction.
 2. Subgrade and drainage fill under floors on grade.
 3. Subgrade, fill and backfill under paving and concrete curbs.
 4. Subgrade, fill and backfill under pedestrian paving.
 5. Backfill adjacent to building and site improvements.
 6. Before placement of granular underslab fill, verify subgrade to assure moisture compaction compliance.
- E. Uncontrolled Compaction:
1. Materials shall be same as approved for controlled fill.
 2. Subgrade and in-place materials shall support fill construction equipment and be compacted sufficiently to preclude settling.
- F. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by SJCF.
- G. Tests will be performed at the following locations and frequencies:
1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.
 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet (30 m) or less of wall length, but no fewer than two tests.

3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet (46 m) or less of trench length, but no fewer than two tests.

3.08 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Remove waste materials, including unacceptable and excess excavated material, trash and debris, and legally dispose of it off property of Owner.
- B. Topsoil to remain on property of Owner unless otherwise indicated. Stockpile or spread soil as directed by SJCF.

3.09 PROTECTION

- A. Protect newly graded areas from traffic and erosion. Provide temporary erosion control where landscaping is not part of the General Construction contract.

3.10 MAINTENANCE

- A. Erosion deeper than 2 inch (50 mm) in any given area to be repaired by the Contractor.
- B. Keep all graded areas free of trash and debris.
- C. Repair and re-establish grades in settled or rutted areas to specified tolerances.
- D. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.
- E. Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn or other finish), add backfill materials, compact, and replace surface treatment. At no added cost to Owner, restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

END OF SECTION

GEOTECHNICAL ENGINEERING REPORT

PROPOSED ADDITION
SEDGWICK COUNTY
ADULT LOCAL DETENTION FACILITY
WICHITA, KANSAS

Terracon Project No. 01965018
April 8, 1996

Prepared for:

BOARD OF COUNTY COMMISSIONERS
Sedgwick County, Kansas

Prepared by:

TERRACON CONSULTANTS, INC.
Wichita, Kansas 67213

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Terracon

April 8, 1996

Board of County Commissioners
Sedgwick County, Kansas
c/o Schaefer Johnson Cox Frey & Associates, P.A.
220 South Hillside
Wichita, Kansas 67211-2197

Attention: Mr. Ed M. Kozar, A.I.A., Vice President

Re: Geotechnical Engineering Report
Proposed Addition to the Sedgwick County Adult Local Detention Facility
Wichita, Kansas
Terracon Project No. 01965018

Terracon

CONSULTANTS, INC.

2111 West Harry Street
Wichita, Kansas 67213-3299
(316) 262-0171 Fax: (316) 262-6997

Gerald W. Finn, P.E.
Kent J. Schwieger, P.E.
Steven R. Fischer, CT
John K. Heinz, P.E.

Gentlemen:

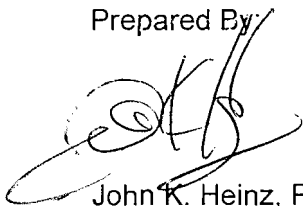
Terracon Consultants, Inc. has completed a subsurface exploration for the proposed Sedgwick County Adult Local Detention Facility addition, in Wichita, Kansas.

The borings indicate that fill materials are present over portions of the site. The native soils encountered generally consist of low to moderately plastic cohesive soils that overlie granular soils that mantle weathered shale bedrock. Recommendations related to supporting the proposed building addition on augered-grout piles and other geotechnical aspects associated with the proposed addition are presented in this report.

We appreciate the opportunity to be of service to you on this project, and we are prepared to provide the recommended construction monitoring and testing services. If you have any questions regarding this report, or if we may be of further service to you in other ways, please let us know.

Sincerely,
TERRACON CONSULTANTS, INC.

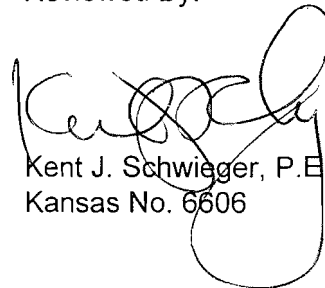
Prepared By:



John K. Heinz, P.E.
Kansas No. 12071

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Reviewed By:



Kent J. Schwieger, P.E.
Kansas No. 6606

Enclosures

Offices of The Terracon Companies, Inc.

Arizona ■ Arkansas ■ Colorado ■ Idaho ■ Illinois ■ Iowa ■ Kansas ■ Minnesota
Missouri ■ Montana ■ Nebraska ■ Nevada ■ Oklahoma ■ Texas ■ Utah ■ Wyoming

Geotechnical, Environmental and Materials Engineers

QUALITY ENGINEERING SINCE 1965

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GEOTECHNICAL ENGINEERING REPORT**PROPOSED ADDITION
SEDGWICK COUNTY ADULT LOCAL DETENTION FACILITY
WICHITA, KANSAS****Terracon Project No. 01965018
April 8, 1996****INTRODUCTION**

A subsurface exploration for the proposed addition to the Sedgwick County Adult Local Detention facility, in Wichita, Kansas, has been completed. Twenty-six borings were drilled at the site to obtain information on subsurface conditions. The results of these borings and a diagram showing their approximate locations are included with this report.

We understand the proposed Sedgwick County Adult Local Detention facility will be a two- to three-level, pre-cast concrete structure. We understand the central portion of the addition is to have column loads approaching 1,000 kips, and the remainder of the building is to have column loads of about 700 kips. At present, an irregular-shaped addition with overall nominal plan dimensions of about 460 feet by 290 feet is to be constructed on the north side of the existing Adult Local Detention Facility. A site plan provided to us by the architect indicates that a future addition with nominal plan dimensions of about 240 feet by 130 feet is to be constructed north of the site addition that is presently proposed. As reported to us, most of the proposed addition will be slab-on-grade construction with a lower-level finished floor elevation of 115 feet. However, a portion of the proposed addition adjacent to the existing facility will have a basement with a finished floor elevation of 101 feet.

In this report, we describe the subsurface conditions encountered in the borings, present the laboratory data obtained, and provide geotechnical recommendations for the design and construction of augered-grout pile foundations. We also are providing recommendations related to geotechnical aspects of the proposed basement, floor slabs, and pavements.

SUBSURFACE EXPLORATION PROCEDURES

The borings were drilled with a truck-mounted, rotary drill rig using continuous- and/or hollow-stem flight augers to advance the boreholes. Representative samples were obtained by the split-barrel sampling procedure in general accordance with ASTM Specification D-1586. In this sampling procedure, a standard, 2-inch O.D., split-barrel sampling spoon is driven into the boring with a 140-pound hammer falling 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of an 18-inch sampling interval is recorded as the standard penetration resistance (N) value. The sampling depths, penetration distances, and the standard penetration resistance values are reported on the boring logs. The samples were sealed and returned to the laboratory for testing and classification.

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A CME automatic SPT hammer was used to advance the split-barrel sampler. A significantly greater efficiency is achieved with the automatic hammer compared with the conventional safety hammer operated with a cathead and rope. This higher efficiency has an appreciable effect on the standard penetration resistance blow count (N) values. The effect of the automatic hammer's efficiency has been considered in our interpretation and analysis.

Field boring logs were prepared by the drill crew as part of the drilling operations. These boring logs include visual classifications of the materials encountered during drilling and the driller's interpretation of the subsurface conditions between samples. The final boring logs included with this report represent the engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in the laboratory.

The boring locations were established in the field by Terracon's drill crew using a calibrated measuring wheel. Right angles for the boring location measurements were estimated. Ground surface elevations indicated on the boring logs are approximate and were derived from a topographic plan that was provided to us by Schaefer Johnson Cox Frey & Associates, P.A.. The elevations at the boring locations could differ due to interpolation and/or superimposing approximate boring locations on the topographic plan. The locations and elevations of the borings should be considered accurate only to the degree implied by the methods used to make these measurements.

LABORATORY TESTING PROGRAM

The split-barrel samples were tested to determine their moisture contents and, where appropriate, their unconfined compressive strengths were estimated with a calibrated hand penetrometer. Atterberg limits tests were performed on representative portions of the near-surface soils, to aid in classification and to help evaluate their shrink-swell characteristics. The results of these laboratory tests are shown on the boring logs adjacent to their respective sample locations.

As part of the testing program, an engineer examined the soil and rock samples in the laboratory. Based on the material's texture and plasticity, the soil samples were described according to the attached **General Notes** and classified in accordance with the **Unified Soil Classification System**. The estimated group symbols for the **Unified Soil Classification System** are shown in the appropriate column on the boring logs. A brief description of the Unified System is included in the appendix. Rock descriptions are in accordance with the **General Notes for Sedimentary Rock** and have been estimated from disturbed samples. Observation of core samples and petrographic analysis may reveal other rock types.

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SITE AND SUBSURFACE CONDITIONS

The project site is located north of the existing Sedgwick County Adult Local Detention facility. Most of this area is relatively level and paved with asphalt. Fill was present in several borings. The native materials encountered at the site consist of alluvial (water-deposited) soils that mantle weathered shale bedrock. Subsurface conditions encountered at the borings are described in greater detail below.

A layer of fill primarily consisting of lean clay with sand, gravel, and brick was encountered to depths of 1 to 4 feet at various locations across the proposed addition. The native soils present just below the fill, topsoil, or pavement generally consisted of stiff to very stiff, lean to fat clays or lean clay with fine sand. These materials continued to depths that ranged from about 3 to 7 feet, where granular materials were typically encountered. Generally the upper portion of the granular soils were described as a medium dense, silty fine sand or fine to medium sand. Below depths of about 10 to 17 feet, the primarily fine-grained sand graded into more coarsely-grained material that field tests indicated was loose to medium dense. The loose to medium dense, more coarsely-graded materials were observed to depths of about 33 to 38 feet, where shale was encountered. Generally the upper 2 to 10 feet of the shale was described as highly weathered. The highly weathered shale transitioned into moderately weathered shale that generally ranged in thickness from about 2 to 6 feet. Typically, the moderately weathered shale was underlain by slightly weathered shale, although at many boring locations, moderately weathered seams were present within the slightly weathered shale.

The subsurface conditions encountered at each boring location are indicated on the boring logs. The stratification boundaries shown on the boring logs represent the approximate locations of changes in soil and rock types; in situ, the transition between material types may be gradual.

WATER LEVEL INFORMATION

The borings were monitored for water while drilling and after completing the drilling operations. Water was encountered at depths that ranged from about 12 to 14 feet below grade at these times. Based on this information and the subsurface conditions encountered at the borings, it is our opinion that the groundwater table was located at a depth of about 13 feet below grade at the time the borings were performed. It should be realized that fluctuations will occur in the level of the groundwater due to seasonal variations in the amount of rainfall, runoff, and the stage of the nearby Arkansas River.

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ANALYSIS AND RECOMMENDATIONS

Due to the relatively high column loads and somewhat compressible nature of the near-surface materials, support of the proposed building addition on a deep foundation system appears practical. Of the possible deep foundation alternatives, in our opinion, augered-grout piles would be the best suited for the proposed addition. Augered-grout piles develop their capacity from a combination of skin friction and end bearing and are installed by drilling continuous-flight, hollow-stem augers to a depth required to support the design pile load. When this depth is reached, a high-strength, non-shrink cement grout is pumped (under pressure) through the hollow shaft of the augers, exiting at the tip of the augers. As pumping continues and an approximately 10-foot grout head develops, the augers are slowly withdrawn until the entire hole is filled with grout.

Based on our analysis, we estimate that a 14-inch diameter pile would need to extend to an elevation of about 62 feet to develop a capacity of 80 tons. This assumes the top of the piles are about elevation 112 feet. For the basement portion of the building, we estimate that the top of the piles will be an elevation of about 99 feet; therefore, the basement piles will need to extend to an elevation of about 59 feet to develop an 80-ton capacity. These recommended tip elevations assume moderately weathered shale is encountered at elevations no deeper than about 66 feet. If, during pile installation, it appears that the moderately weathered shale is encountered at greater depths, it may be necessary to deepen the piles to achieve the recommended capacity. The estimated capacity is based on static analysis and utilizes a minimum safety factor of about 2 for skin friction and 2.5 for end bearing, which are the minimum recommended values for design purposes. We recommend at least two pile load tests be performed at the site to verify pile capacity.

Regarding construction of augered-grout piles, we expect that it may be difficult to penetrate the moderately to slightly weathered shale encountered below an elevations of about 70 feet. As a minimum, the augers should be equipped with rock cutting teeth.

Because the capacity of augered-grout piles depends not only on the depth of penetration, but also on the installation procedure used to construct the piles, we recommend that a representative of Terracon Consultants, Inc. be present during the installation of the augered-grout piles, to monitor the pile installation process and to perform tests to evaluate grout strength. We estimate that long-term settlement for augered-grout piling, which are designed and constructed as outlined above and extend into the moderately to slightly weathered shale, would be minor, less than 3/4 inch. Differential settlement is not expected to exceed about one-half this value.

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Slab-on-Grade Subgrade Preparation: We recommend that all surface vegetation, topsoil, and existing pavement be removed from the proposed building footprint. Following completion of these operations, we recommend the exposed subgrade be proofrolled (in the presence of Terracon's representative) using a loaded, tandem-axle dump truck or scraper, to locate zones that are soft or unstable. The subgrade in areas where rutting or pumping occurs during proofrolling should be removed and replaced with suitable fill, as described below, if it cannot be compacted in-place.

A factor affecting floor slab performance is the potential for the subgrade soils to swell due to variations in moisture content. Typically, some increase in the floor slab subgrade moisture content will occur throughout the life of the structure, due to leaks in utility lines and also as a result of the gradual accumulation of capillary moisture, which would otherwise evaporate if the floor slab had not been constructed. A soil's swell potential is dependent primarily on its plasticity and moisture content. Based on the conditions encountered at the borings, the near surface soils are moderately plastic and presently are moist to relatively dry. In our opinion, these materials have low to moderate swell potential. To limit floor slab heave to a small amount, less than about 1/2 inch, we recommend that all fill and at least the upper 12 inches (excluding any granular leveling course or capillary moisture break) be low volume change material that is free of organic matter and debris.

By our definition, low volume change soils would be cohesive materials having a liquid limit less than 45 and a plasticity index less than 18. Granular soils with at least 15% fines (materials passing the #200 sieve), such as silty sand, silty gravel, or limestone screenings, also could be used to develop the low volume change zone. Based on the borings it appears that most of the in situ soils would meet this criteria. If sufficient quantities of the low volume change material are not available locally, a low volume change zone could be developed by modifying more plastic cohesive soils with hydrated lime or Class C fly ash.

It has been our experience that lime contents of 4% to 6% or Class C fly ash contents of 14% to 16%, based on dry weight of material, would be required to appreciably reduce the shrink/swell characteristics of more plastic cohesive materials that do not meet the above criteria.

After completing the proofrolling, undercutting where needed, and prior to placing areal fill, we recommend the upper 9 inches of exposed subgrade be compacted to at least 95% of standard Proctor maximum density at moisture contents not less than optimum. All additional fill should be placed in lifts not exceeding 9 inches in loose thickness and compacted to at

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least 95% of standard Proctor maximum density. Cohesive soils should be placed at moisture contents not less than optimum. Granular soils should be placed at a workable moisture content. Lime- or fly ash-modified soils should be placed at moisture contents within 2% of optimum.

Even some low volume change materials can be swell susceptible if allowed to dry before constructing the floor slab; therefore, it is important that the recommended moisture content be maintained in the subgrade materials below the floor slab. We recommend that the subgrade soils be evaluated about 3 to 4 days before placing concrete. If excessive wetting or drying of the subgrade materials has occurred at this time, it is important that measures be taken to adjust the moisture content and recompaction to meet the recommendations described above.

Basement Considerations: The sides of the basement excavation should be sloped or braced for stability. Because we expect the excavation for the basement will extend close to the groundwater table, we anticipate that well points or deep well(s) will be needed to permit basement construction to proceed "in the dry."

We recommend the basement walls, which will be subjected to unbalanced lateral forces, be designed for earth-pressure conditions, as presented on the diagrams in the appendix. One diagram is for granular backfill and the other is for cohesive backfill. Please note that these are for "at-rest" stress distributions, based on a condition of no wall rotation, which we expect would be applicable for a basement wall. The values indicated on this diagram do not include a safety factor or consider hydrostatic loads.

Based on present water level information, it appears that the groundwater table is slightly below proposed basement floor slab level. Fluctuations in groundwater levels, which could adversely affect the proposed basement, are expected to occur during the life of the structure. From the available information we have on groundwater level fluctuations in the vicinity of the proposed project, it is our opinion that the groundwater table could rise about 5 feet above present levels during periods of prolonged heavy precipitation, such as experienced in the Spring 1973 and Summer 1993.

To reduce the potential for hydrostatic pressures to develop and groundwater to enter the basement, a perimeter and under-floor slab drainage system connected to a sump is recommended. The relatively clean, generally fine to coarse sand that is expected to be encountered at basement level suggests that, at times when the groundwater table is

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elevated, the drainage system would need to be designed to handle a significant volume of seepage water. The volume of seepage water will depend on the size of the basement. We could provide an estimate of the expected volume of seepage water that would need to be discharged to prevent the formation of hydrostatic pressures once the final basement size and configuration have been established.

To provide a hydraulic connection between the sump and the basement floor/walls, we recommend that rigid, smooth, perforated, slotted plastic or metal drain lines, with a minimum diameter of 6 inches, be installed below the floor slab and adjacent to the outside and inside of the basement perimeter walls. The bottom of the drain line should be at least 1 foot below basement floor slab level.

The perimeter drains should be surrounded by a minimum of 6-inches of appropriately-sized, granular filter material. As an alternative, the perimeter drains could be encapsulated with suitable filter fabric. The area above the perimeter drains extending at least 24 inches out from the wall should be backfilled with free-draining coarse sand.

The under-slab drains should be placed in a granular drainage blanket at least 9 inches thick. This blanket should be constructed of free-draining granular material, such as BD-1, as specified by the K.D.O.T. The below-slab drains should extend parallel to the long dimensions of the basement and be spaced on centers not greater than 15 feet. To prevent migration of the fine to coarse sand below the drainage layer entering the drainage blanket, we recommend that a filter fabric be placed below the granular drainage layer.

From our review of available groundwater level information in downtown Wichita, it appears that the groundwater table will often be below basement floor elevation and, therefore, is not expected to accumulate in the under-slab drainage system. However, because it is possible that a power outage could occur at times when the groundwater table is elevated, we recommend that consideration be given to providing a battery or auxiliary power source for the sump pump. Also, if the pump were to fail when the groundwater table is elevated, hydrostatic forces could develop and/or the basement could flood. Therefore, consideration also should be given to installing a backup pump.

Pavement Subgrade Preparation: The recommendations presented in the "**Slab-on-Grade Subgrade Preparation**" section of the report regarding stripping and proofrolling should be followed. Following completion of these operations, we recommend the upper 9 inches of

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exposed subgrade be scarified and compacted to at least 95% of standard Proctor maximum density at moisture contents wet of optimum.

Additional fill required to develop design grade should be an approved material that is free of organic matter and debris. The fill should be placed in lifts not exceeding 9 inches in loose thickness and, except for the upper 8 inches of materials directly below the pavement, the fill should be compacted to at least 95% of standard Proctor maximum density. The upper 8 inches of subgrade material below the pavement should be compacted to at least 98% of standard Proctor maximum density. Cohesive fill used below pavements should be placed at moisture contents not less than optimum.

Pavement support capacity of the on-site soils can be enhanced and pavement thickness can be reduced by modifying the upper 8 inches of cohesive material directly below the pavement with lime or Class C fly ash. Class C fly ash also may be effective in increasing the subgrade support of the on-site silty sand obtained from the basement excavation. We recommend using the moisture criteria and application rates of lime or fly ash previously described in the **"Slab-on-Grade Subgrade Preparation"** section. The modified zone should extend at least 1 foot beyond the edge of the pavement. If hydrated lime is used to modify the subgrade soils, it would be necessary to allow at least 48 hours for the lime reactions to proceed prior to final compaction of the modified zone. Soils mixed with Class C fly ash should be compacted within 2 hours following blending operations. Recognized guidelines, such as those specified by the City of Wichita or K.D.O.T., should be followed in the mixing and/or blending of lime- or fly ash-modified material.

It is important that the moisture content of the subgrade soils be maintained prior to paving. We recommend the subgrade moisture be evaluated several days before paving. If drying or softening of the subgrade has occurred, measures should be taken to adjust the moisture and compaction of the subgrade materials before paving.

Pavements: The following table represents the recommended minimum thicknesses of pavements constructed on properly prepared soil subgrades or subgrades treated with lime or fly ash, and assumes periodic maintenance will be performed throughout the life of the pavement.

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RECOMMENDED MINIMUM PAVEMENT SECTIONS (Inches)				
	CAR PARKING & DRIVE AREAS LIGHT DUTY		TRUCK DRIVE AREAS HEAVY DUTY*	
	MODIFIED	UNTREATED	MODIFIED	UNTREATED
PORTLAND CEMENT CONCRETE:	5.0	5.0	5.5	6.0
Air Entrained				
4,000 Psi Compressive				
650 Psi Flexural				
ASPHALTIC CONCRETE:				
Surface Course (BM-2, KDOT Mix)	2.0	2.0	2.0	2.0
Base Course (BM-4, KDOT Mix)	2.5	3.5	4.0	5.0
MODIFIED SUBGRADE:				
5% to 6% Hydrated Lime or	8.0		8.0	
14% to 16% Class C Fly Ash				
98% Compacted Dry Density				
(ASTM D-698, Standard Proctor)				

*Subject to light truck traffic and up to the equivalent of two, semi-tractor-trailers per day based on a 20-year design life. Pavements subjected to greater truck volumes would require thicker sections.

All pavement surfaces should be sloped to provide proper surface drainage. Water allowed to pond on or adjacent to the pavement could saturate the subgrade and cause premature pavement deterioration.

GENERAL COMMENTS

The analyses and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and any other information discussed in this report. This report does not reflect any variations that may occur between borings or across the site. The nature and extent of such variations may not become evident until construction. If variations appear evident, it will be necessary to re-evaluate the recommendations of this report.

We recommend that the geotechnical engineer be given the opportunity to review the plans and specifications so that comments can be made regarding the interpretation and implementation of our geotechnical recommendations in the design and specifications. We further recommend that the geotechnical engineer be retained for testing and observation during earthwork and foundation construction phases to help determine that the design requirements are fulfilled.

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This report has been prepared according to generally accepted geotechnical engineering practices for the exclusive use of our client for specific application to the project discussed. No warranties, either express or implied, are intended or made. If any changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report are modified or verified in writing by the geotechnical engineer.

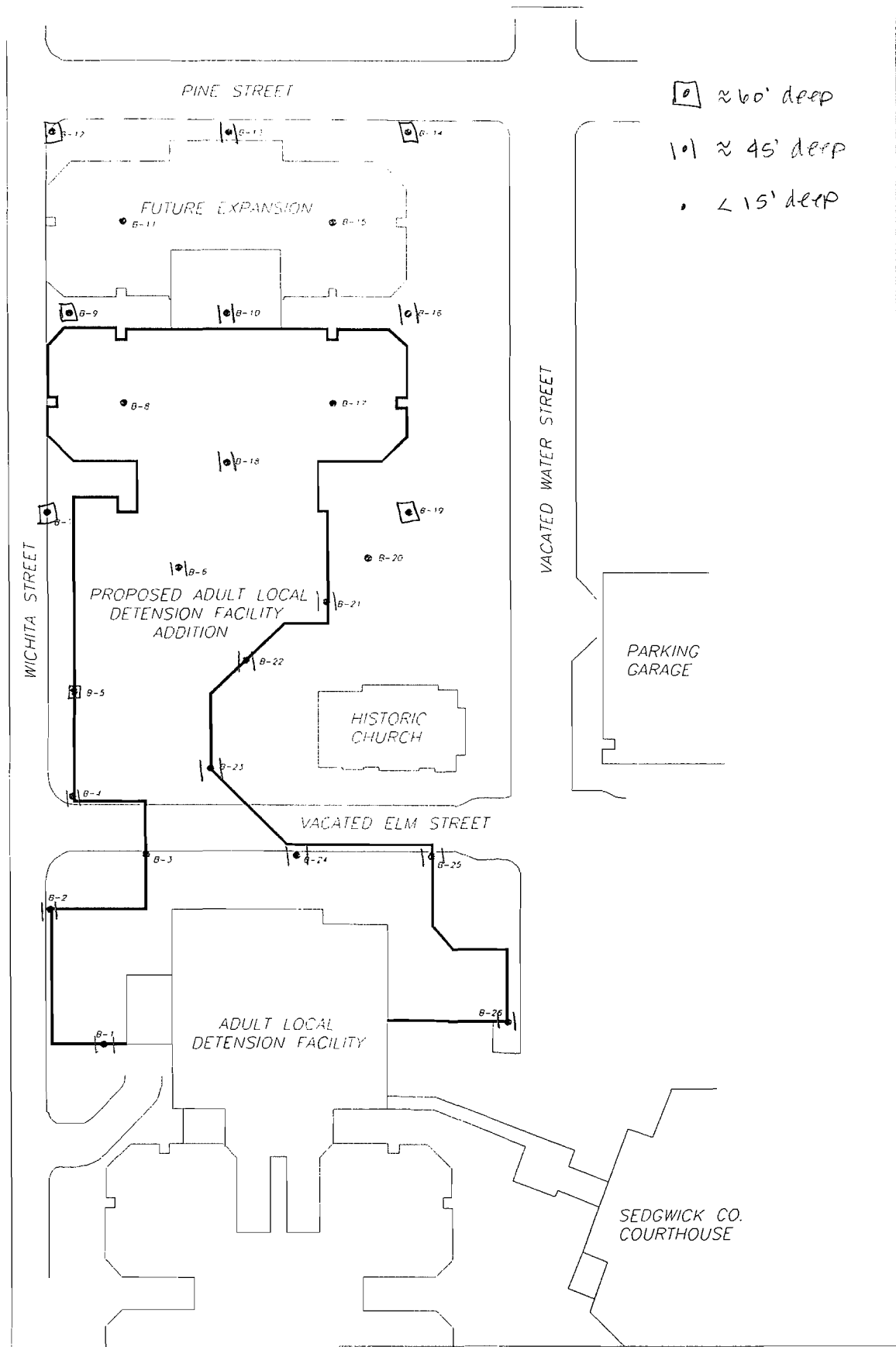
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APPENDIX



LEGEND

● BORING LOCATION



**BORING LOCATION MAP
PROPOSED ADULT LOCAL DETENTION FACILITY ADDITION**

WICHITA, KANSAS

PROJECT MNGR: JKH

DESIGNED BY:

DRAWN BY: MEK

CHECKED BY:

APPROVED BY: KJS

Terracon
GEOTECHNICAL, INC.
2111 W. Harry Street
Wichita, Kansas 67213

PROJ #01965018

SCALE: SHOWN

FN: 01965018

DATE: MAR. 1996

DRAWING NO: Figure 1

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS : Split Spoon - 1½" I.D., 2" O.D., unless otherwise noted	PS : Piston Sample
ST : Thin-Walled Tube - 2" O.D., Unless otherwise noted	WS : Wash Sample
PA : Power Auger	FT : Fish Tail Bit
HA : Hand Auger	RB : Rock Bit
DB : Diamond Bit - 4", N, B	BS : Bulk Sample
AS : Auger Sample	PM : Pressuremeter
HS : Hollow Stem Auger	DC : Dutch Cone
	WB : Wash Bore

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch OD split spoon, except where noted.

WATER LEVEL MEASUREMENT SYMBOLS:

WL : Water Level	WS : While Sampling
WCI : Wet Cave In	WD : While Drilling
DCI : Dry Cave In	BCR : Before Casing Removal
AB : After Boring	ACR : After Casing Removal

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of ground water levels is not possible with only short term observations.

DESCRIPTIVE SOIL CLASSIFICATION:

Soil Classification is based on the Unified Soil Classification System and ASTM Designations D-2487 and D-2488. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: clays, if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse grained soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their consistency. Example: Lean clay with sand, trace gravel, stiff (CL); silty sand, trace gravel, medium dense (SM).

CONSISTENCY OF FINE-GRAINED SOILS:

Unconfined Compressive Strength, Qu, psf	Consistency
< 500	Very Soft
500 - 1,000	Soft
1,001 - 2,000	Medium
2,001 - 4,000	Stiff
4,001 - 8,000	Very Stiff
8,001 -16,000	Hard
> -16,000	Very Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS:

N-Blows/ft.	Relative Density
0-3	Very Loose
4-9	Loose
10-29	Medium Dense
30-49	Dense
50-80	Very Dense
80+	Extremely Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) (of Components Also Present in Sample)	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) (of Components Also Present in Sample)	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

GRAIN SIZE TERMINOLOGY

Major Component Of Sample	Size Range
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 sieve (0.075mm)

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GENERAL NOTES

Sedimentary Rock Classification

DESCRIPTIVE ROCK CLASSIFICATION:

Sedimentary rocks are composed of cemented clay, silt and sand sized particles. The most common minerals are clay, quartz and calcite. Rock composed primarily of calcite is called limestone; rock of sand size grains is called sandstone, and rock of clay and silt size grains is called mudstone or claystone, siltstone, or shale. Modifiers such as shaly, sandy, dolomitic, calcareous, carbonaceous, etc. are used to describe various constituents. Examples: sandy shale; calcareous sandstone.

LIMESTONE	Light to dark colored, crystalline to fine-grained texture, composed of CaCO_3 , reacts readily with HCl.
DOLOMITE	Light to dark colored, crystalline to fine-grained texture, composed of $\text{CaMg}(\text{CO}_3)_2$, harder than limestone, reacts with HCl when powdered.
CHERT	Light to dark colored, very fine-grained texture, composed of micro-crystalline quartz (SiO_2), brittle, breaks into angular fragments, will scratch glass.
SHALE	Very fine-grained texture, composed of consolidated silt or clay, bedded in thin layers. The unlaminated equivalent is frequently referred to as siltstone, claystone or mudstone.
SANDSTONE	Usually light colored, coarse to fine texture, composed of cemented sand size grains of quartz, feldspar, etc. Cement usually is silica but may be such minerals as calcite, iron-oxide, or some other carbonate.
CONGLOMERATE	Rounded rock fragments of variable mineralogy varying in size from near sand to boulder size but usually pebble to cobble size ($\frac{1}{2}$ inch to 6 inches). Cemented together with various cementing agents. Breccia is similar but composed of angular, fractured rock particles cemented together.

DEGREE OF WEATHERING:

SLIGHT	Slight decomposition of parent material on joints. May be color change.
MODERATE	Some decomposition and color change throughout.
HIGH	Rock highly decomposed, may be extremely broken.

Classification of rock materials has been estimated from disturbed samples.
Core samples and petrographic analysis may reveal other rock types.

LOG OF BORING NO. B-1

Page 1 of 2

CLIENT Sedgwick County, Kansas				ARCHITECT/ENGINEER SJCF & Associates, PA								
SITE Wichita, Kansas				PROJECT Sedgwick County Adult Detention Facility								
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES				TESTS				
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH, PSF		
	Approx. Surface Elev.: 115.1 ft.											
	4 Inches Topsoil				PA							
	<u>FILL: LEAN CLAY</u> , Trace Sand and Gravel; Dark Brown to Brown			1	SS	18	6	16.3			5000*	
					PA							
	5.0 110.1	5										
	<u>SILTY FINE SAND</u> ; Brown; Medium Dense		SM	2	SS	18	11	5.5				
					PA							
		10										
	12.0 103.1		SW	3	SS	18	9	4.6				
	<u>FINE TO COARSE SAND</u> , Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose to Medium Dense				PA							
		15										
		20										
		25										

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

* Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	15.5	WD	15.5	AB
WL		WD		
WL		WD		

Terracon

BORING STARTED	2-22-96
BORING COMPLETED	2-22-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

LOG OF BORING NO. B-1

Page 2 of 2

CLIENT Sedgwick County, Kansas		ARCHITECT/ENGINEER SJCF & Associates, PA							
SITE Wichita, Kansas		PROJECT Sedgwick County Adult Detention Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES				TESTS	
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF
	<u>FINE TO COARSE SAND</u> , Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose to Medium Dense								
		30							
		35							
	37.5 77.6								
	38.5 <u>HIGHLY WEATHERED SHALE</u> ; Olive-Gray to Dark Gray 76.6								
	<u>MODERATELY WEATHERED SHALE</u> ; With Occasional Gypsum Seams; Gray	40							
	45.0 70.1	45							
	BOTTOM OF BORING								
	**Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.								

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

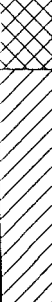



WL	▽	15.5	WD	▽	15.5	AB
WL	▽		WD	▽		
WL			WD			

Terracon

BORING STARTED	2-22-96
BORING COMPLETED	2-22-96
RIG	CME 75
FOREMAN	AT/MM
APPROVED	JKH
JOB #	01965018

LOG OF BORING NO. B-2

Page 1 of 2

CLIENT		ARCHITECT/ENGINEER									
Sedgwick County, Kansas		SJCF & Associates, PA									
SITE		PROJECT									
Wichita, Kansas		Sedgwick County Adult Detention Facility									
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES				TESTS			
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH, PSF	
	Approx. Surface Elev.: 112.8 ft.										
	1.5 <u>FILL: LEAN CLAY WITH SAND, GRAVEL, AND BRICK; Dark Brown</u> 111.3			PA							
	<u>LEAN CLAY WITH FINE SAND; Brown to Dark Brown; Stiff</u>		CL	1	SS	18	4	13.7		6000*	LL = 38 PL = 17 PI = 21
	6.5 106.3	5		PA							
	<u>SILTY FINE SAND; Brown; Medium Dense</u>		SM	2	SS	18	14	3.6			
	11.5 101.3	10		PA							
	<u>FINE TO COARSE SAND, Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose to Medium Dense</u> ▼		SW	3	SS	18		6.3			
		15		PA							
		20									
		25									
Continued Next Page											

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

* Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.					
WL	▽	14.0	WD	▽	14.0 AB
WL	▽		WD	▽	
WL					

Terracon

BORING STARTED	2-22-96
BORING COMPLETED	2-22-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

LOG OF BORING NO. B-2

Page 2 of 2

CLIENT Sedgwick County, Kansas		ARCHITECT/ENGINEER SJCF & Associates, PA							
SITE Wichita, Kansas		PROJECT Sedgwick County Adult Detention Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF
	<u>FINE TO COARSE SAND</u> , Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose to Medium Dense								
		36.0	76.8						
	<u>HIGHLY WEATHERED SHALE</u> ; Olive-Gray to Dark Gray								
		41.0	71.8						
	<u>MODERATELY WEATHERED SHALE</u> ; With Occasional Gypsum Seams; Gray								
		43.0	69.8						
	<u>HIGHLY WEATHERED SHALE</u> ; Olive-Gray to Dark Gray								
		45.0	67.8						
	BOTTOM OF BORING								
	**Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.								

The stratification lines represent the approximate boundary lines between soil and rock types; in-situ, the transition may be gradual.

* Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

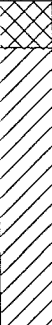


WL	▽	14.0	WD	▽	14.0	AB
WL	▽		▽			
WL						

Terracon

BORING STARTED		2-22-96
BORING COMPLETED		2-22-96
RIG	CME 75	FOREMAN AT/MM
APPROVED	JKH	JOB # 01965018

LOG OF BORING NO. B-3

Page 1 of 1

CLIENT		ARCHITECT/ENGINEER									
Sedgwick County, Kansas		SJCF & Associates, PA									
SITE		PROJECT									
Wichita, Kansas		Sedgwick County Adult Detention Facility									
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES				TESTS			
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH, PSF	
	Approx. Surface Elev.: 112.4 ft.										
	1.0 FILL: LEAN CLAY WITH SAND, GRAVEL, AND BRICK; Dark Brown	111.4		PA							
	LEAN CLAY WITH FINE SAND; Brown; Stiff		CL	1	SS	18	4	11.6		5500*	
					PA						
	7.0	105.4									
	SILTY FINE SAND; Brown; Medium Dense		SM	2	SS	18	10	7.9			
					PA						
	11.0	101.4									
	FINE TO COARSE SAND, Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose to Medium Dense		SW	3	SS	18	9	4.7			
	13.5	98.9									
	BOTTOM OF BORING										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.					
WL	▽	12.0	WS	▽	11.5 AB
WL	▽			▽	
WL					

Terracon

BORING STARTED		2-22-96
BORING COMPLETED		2-22-96
RIG	CME 75	FOREMAN AT/MM
APPROVED	JKH	JOB # 01965018

N3BLGE 65018 3/14/96

LOG OF BORING NO. B-4

Page 1 of 2

CLIENT Sedgwick County, Kansas		ARCHITECT/ENGINEER SJCF & Associates, PA							
SITE Wichita, Kansas		PROJECT Sedgwick County Adult Detention Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF
	Approx. Surface Elev.: 112.7 ft.								
	2 Inches Asphalt			PA					
	2.5 <u>LEAN TO FAT CLAY</u> ; Dark Brown to Brown; Very Stiff 110.2		CL	1	SS	18	17	9.6	9000*
	<u>LEAN CLAY WITH FINE SAND</u> ; Brown to Dark Brown; Stiff				PA				
	6.0 106.7								
	<u>SILTY FINE SAND</u> ; Brown; Medium Dense		SM	2	SS	18	16	3.7	
	10.5 102.2				PA				
	<u>FINE TO COARSE SAND</u> , Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose to Medium Dense		SW	3	SS	18	7	4.2	
					PA				

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

* Calibrated Hand Penetrometer

N3BLGE 65018 3/14/98

WATER LEVEL OBSERVATIONS, Ft.				
WL	▽	12.0	WS	▽ 12.5 AB
WL	▽		WS	▽
WL				

Terracon

BORING STARTED	2-20-96
BORING COMPLETED	2-20-96
RIG	CME 75
FOREMAN	AT/MM
APPROVED	JKH
JOB #	01965018

LOG OF BORING NO. B-4

Page 2 of 2

CLIENT Sedgwick County, Kansas			ARCHITECT/ENGINEER SJCF & Associates, PA							
SITE Wichita, Kansas			PROJECT Sedgwick County Adult Detention Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES			TESTS			
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH, PSF
	<u>FINE TO COARSE SAND</u> , Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose to Medium Dense	36.0	76.7							
	<u>HIGHLY WEATHERED SHALE</u> ; Olive-Gray to Dark Gray	43.0	69.7							
	<u>MODERATELY WEATHERED SHALE</u> ; With Occasional Gypsum Seams; Gray	45.0	67.7							
	BOTTOM OF BORING **Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	▽	12.0	WS	▽	12.5	AB
WL	▽		WS	▽		
WL						

Terracon

BORING STARTED	2-20-96
BORING COMPLETED	2-20-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

LOG OF BORING NO. B-5

Page 1 of 3

CLIENT Sedgwick County, Kansas				ARCHITECT/ENGINEER SJCF & Associates, PA			
SITE Wichita, Kansas				PROJECT Sedgwick County Adult Detention Facility			
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES			TESTS
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.
	Approx. Surface Elev.: 112.6 ft.						MOISTURE, %
	3 Inches Asphalt				HS		DRY DENSITY PCF
	2.0 LEAN TO FAT CLAY; Dark Brown to Brown; Very Stiff 110.6						UNCONFINED STRENGTH, PSF
	LEAN CLAY WITH FINE SAND; Brown to Dark Brown; Stiff	5					
	6.5 106.1						
	SILTY FINE SAND; Brown; Medium Dense		SM	1	SS	18	16
					HS		4.1
		10					
		15					
	16.0 96.6						
	FINE TO COARSE SAND, Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Medium Dense		SW	2	SS	18	17
					HS		11.8
		20					
		25					

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	▽	12.0	WS	▽	12.0	AB
WL	▽		WS	▽		
WL						

Terracon

BORING STARTED	2-20-96
BORING COMPLETED	2-20-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

LOG OF BORING NO. B-5

Page 2 of 3

CLIENT Sedgwick County, Kansas			ARCHITECT/ENGINEER SJCF & Associates, PA		
SITE Wichita, Kansas			PROJECT Sedgwick County Adult Detention Facility		
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	SAMPLES		
			USCS SYMBOL	NUMBER	TESTS
				TYPE	RECOVERY, IN.
				SPT - N BLOWS / FT.	MOISTURE, %
				DRY DENSITY PCF	UNCONFINED STRENGTH, PSF
	FINE TO COARSE SAND, Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Medium Dense		SW	3	SS 18 18 18.5
		30		HS	
		35			
	37.0 75.6			4	SS 18 29 27.3 9000*
	38.5 HIGHLY WEATHERED SHALE; Olive-Gray to Dark Gray 74.1			HS	
	MODERATELY WEATHERED SHALE; With Occasional Gypsum Seams; Gray	40			
		45			
	47.0 65.6			5	SS HS 2 50/2" 25.6 7500*
	SLIGHTLY WEATHERED SHALE; With Numerous Gypsum; Gray	50			
Continued Next Page					

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.				
WL	▽	12.0	WS	▽
WL	▽		WS	▽
WL			WS	▽

Terracon

BORING STARTED	2-20-96
BORING COMPLETED	2-20-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

LOG OF BORING NO. B-5

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CLIENT Sedgwick County, Kansas		ARCHITECT/ENGINEER SJCF & Associates, PA								
SITE Wichita, Kansas		PROJECT Sedgwick County Adult Detention Facility								
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH, PSF
	<u>SLIGHTLY WEATHERED SHALE</u> ; With Numerous Gypsum; Gray									
				6	SS	18	63	27.1		9000*
	BOTTOM OF BORING **Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

* Calibrated Hand Penetrometer

N3BLGE 65018 3/14/96

WATER LEVEL OBSERVATIONS, Ft.				BORING STARTED		2-20-96
WL	▽	12.0	WS	▽	12.0	AB
WL	▽					
WL						
				BORING COMPLETED		2-20-96
				RIG	CME 75	FOREMAN AT/MM
				APPROVED	JKH	JOB # 01965018

LOG OF BORING NO. B-6

Page 1 of 2

CLIENT Sedgwick County, Kansas				ARCHITECT/ENGINEER SJCF & Associates, PA			
SITE Wichita, Kansas				PROJECT Sedgwick County Adult Detention Facility			
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES			TESTS
				NUMBER	TYPE	RECOVERY, IN. SPT - N BLOWS / FT.	MOISTURE, % DRY DENSITY PCF UNCONFINED STRENGTH, PSF
	Approx. Surface Elev.: 113.5 ft.						
	2 Inches Asphalt				PA		
	LEAN CLAY WITH FINE SAND; Brown to Dark Brown; Stiff		CL	1	SS	18 6	13.9 6500*
	4.0 109.5				PA		
	SILTY FINE SAND; Brown; Medium Dense	5					
			SM	2	SS	18 16	5.8
					PA		
	11.0 102.5	10					
	FINE TO COARSE SAND, Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose to Medium Dense		SW	3	SS	18 9	6.4
					PA		
		15					
		20					
		25					

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

* Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	▽	12.0	WS	▽	12.5	AB
WL	▽		WS	▽		
WL						

Terracon

BORING STARTED	2-20-96
BORING COMPLETED	2-20-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

LOG OF BORING NO. B-7

Page 2 of 3

CLIENT Sedgwick County, Kansas		ARCHITECT/ENGINEER SJCF & Associates, PA									
SITE Wichita, Kansas		PROJECT Sedgwick County Adult Detention Facility									
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES				TESTS			
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH, PSF	
	<u>FINE TO COARSE SAND</u> , Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose										
		30									
			SW	4	SS	18	8	29.4			
33.0		80.3									
	<u>HIGHLY WEATHERED SHALE</u> ; Olive-Gray to Dark Gray				HS						
	Becoming Gray Below 41 Feet	35									
		40									
				5	SS	18	13	28.5		5000*	
		45			HS						
48.0		65.3									
		50									
	Continued Next Page										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	12.0	WD	15.0	AB
WL		WD		
WL		WD		

Terracon

BORING STARTED	2-20-96
BORING COMPLETED	2-20-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

LOG OF BORING NO. B-7

Page 3 of 3

CLIENT Sedgwick County, Kansas			ARCHITECT/ENGINEER SJCF & Associates, PA							
SITE Wichita, Kansas			PROJECT Sedgwick County Adult Detention Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH, PSF
	<u>MODERATELY WEATHERED SHALE;</u> With Occasional Gypsum Seams; Gray									
				6	SS	18	48	24.3		6000*
54.0	59.3				HS					
	<u>SLIGHTLY WEATHERED SHALE;</u> With Numerous Gypsum; Gray	55								
59.0	54.3									
60.0	<u>HIGHLY WEATHERED SHALE;</u> Olive-Gray to Dark Gray	60								
	<u>MODERATELY WEATHERED SHALE;</u> With Occasional Gypsum Seams; Gray									
62.0	51.3									
	<u>HIGHLY WEATHERED SHALE;</u> Olive-Gray to Dark Gray			7	SS	18	26	22.7		7500*
63.5	49.8									
	BOTTOM OF BORING **Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	▽	12.0	WD	▽	15.0	AB
WL	▽		WD	▽		
WL						

Terracon

BORING STARTED	2-20-96
BORING COMPLETED	2-20-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

LOG OF BORING NO. B-8

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CLIENT Sedgwick County, Kansas				ARCHITECT/ENGINEER SJCF & Associates, PA			
SITE Wichita, Kansas				PROJECT Sedgwick County Adult Detention Facility			
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES			TESTS
				NUMBER	TYPE	RECOVERY, IN. SPT - N BLOWS / FT.	MOISTURE, % DRY DENSITY PCF UNCONFINED STRENGTH, PSF
	Approx. Surface Elev.: 113.6 ft.						
	3 Inches Asphalt				PA		
	<u>LEAN TO FAT CLAY</u> ; Dark Brown to Brown; Very Stiff		CL	1	SS	18 10	20.6 7500*
		3.0 110.6					
	<u>LEAN CLAY WITH FINE SAND</u> ; Brown to Dark Brown; Stiff				PA		
		7.0 106.6					
	<u>SILTY FINE SAND</u> ; Brown; Medium Dense		SM	2	SS	18 13	4.2
		10.5 103.1			PA		
	<u>FINE TO MEDIUM SAND</u> , Trace Silt; Brown; Medium Dense		SP	3	SS	18 15	7.9
		13.5 100.1					
	BOTTOM OF BORING						

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

* Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	▽	NONE	WD	▽	NONE	AB
WL	▽		WD	▽		
WL			WD			



Terracon

BORING STARTED	2-20-96
BORING COMPLETED	2-20-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

N3BLGE 65018 3/14/96

LOG OF BORING NO. B-9

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CLIENT		ARCHITECT/ENGINEER							
Sedgwick County, Kansas		SJCF & Associates, PA							
SITE		PROJECT							
Wichita, Kansas		Sedgwick County Adult Detention Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF
	Approx. Surface Elev.: 113.7 ft.								
	2 Inches Asphalt			HS					
	<u>LEAN TO FAT CLAY</u> ; Dark Brown to Brown; Very Stiff		CL-CH	1	SS	18	11	25.0	2000*
	3.5 110.2			HS					
	5.0 <u>LEAN CLAY WITH FINE SAND</u> ; Brown to Dark Brown; Stiff 108.7	5							
	<u>SILTY FINE SAND</u> ; Brown; Medium Dense								
	11.0 102.7	10							
	<u>FINE TO MEDIUM SAND</u> , Trace Silt;  Brown; Medium Dense 		SP	2	SS	18	10	14.1	
				HS					
	20.5 93.2	20							
	<u>FINE TO COARSE SAND</u> , Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose		SW	3	SS	18	6	13.4	
				HS					
		25							
Continued Next Page									

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.						
WL	▽	12.0	WS	▽	13.0	AB
WL	▽			▽		
WL						

Terracon

BORING STARTED	2-21-96
BORING COMPLETED	2-21-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

N3BLGE 65018 3/14/96

LOG OF BORING NO. B-9

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CLIENT Sedgwick County, Kansas	ARCHITECT/ENGINEER SJCF & Associates, PA
SITE Wichita, Kansas	PROJECT Sedgwick County Adult Detention Facility

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH, PSF
	<u>FINE TO COARSE SAND</u> , Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose Becoming Medium Dense Below 31 Feet	30								
			SW	4	SS	18	9	12.8		
					HS					
35.5		35								
	<u>HIGHLY WEATHERED SHALE</u> ; Olive-Gray to Dark Gray Becoming Gray Below 37 Feet	40								
				5	SS	18	15	27.1		9000*
					HS					
46.0		45								
	<u>MODERATELY WEATHERED SHALE</u> ; With Occasional Gypsum Seams; Gray									
49.0										
		50								

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.				
WL	▽	12.0	WS	▽
WL	▽		WS	▽
WL				

Terracon

BORING STARTED	2-21-96
BORING COMPLETED	2-21-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

N3BLGE 65018 3/14/96

LOG OF BORING NO. B-9

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CLIENT Sedgwick County, Kansas				ARCHITECT/ENGINEER SJCF & Associates, PA							
SITE Wichita, Kansas				PROJECT Sedgwick County Adult Detention Facility							
GRAPHIC LOG	DESCRIPTION			DEPTH (FT.)	USCS SYMBOL	SAMPLES			TESTS		
						NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF
	51.5 <u>HIGHLY WEATHERED SHALE;</u> Olive-Gray to Dark Gray 62.2										
	<u>SLIGHTLY WEATHERED SHALE;</u> With Numerous Gypsum; Gray					6	SS PA	6	50/6"	22.5	4500*
				55							
	57.8 55.9					7	SS	8	50/3"	27.9	6500*
	BOTTOM OF BORING										
	**Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	▽	12.0	WS	▽	13.0	AB
WL	▽			▽		
WL						

Terracon

BORING STARTED	2-21-96
BORING COMPLETED	2-21-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

N3BLGE 65018 3/14/96

LOG OF BORING NO. B-10

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CLIENT Sedgwick County, Kansas			ARCHITECT/ENGINEER SJCF & Associates, PA							
SITE Wichita, Kansas			PROJECT Sedgwick County Adult Detention Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF	
	Approx. Surface Elev.: 113.8 ft.									
	2 Inches Asphalt				PA					
	2.0 <u>FILL: LEAN CLAY WITH SAND, GRAVEL, AND BRICK; Dark Brown</u> 111.8		CL	1	SS	18	4	25.4		2500*
	<u>LEAN CLAY WITH FINE SAND; Brown to Dark Brown; Stiff</u>				PA					
	5.5 108.3	5								
	<u>SILTY FINE SAND; Brown; Medium Dense</u>		SM	2	SS	18	20	6.8		
	11.0 102.8	10			PA					
	<u>FINE TO COARSE SAND, Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose to Medium Dense</u>		SW	3	SS	18	9	10.5		1000*
		15			PA					
		20								
		25								

Continued Next Page

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	▽	12.5	WS	▽	13.5	AB
WL	▽		WS	▽		
WL						

Terracon

BORING STARTED	2-19-96
BORING COMPLETED	2-19-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

LOG OF BORING NO. B-10

Page 2 of 2

CLIENT Sedgwick County, Kansas		ARCHITECT/ENGINEER SJCF & Associates, PA							
SITE Wichita, Kansas		PROJECT Sedgwick County Adult Detention Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES				TESTS	
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF
	<u>FINE TO COARSE SAND</u> , Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose to Medium Dense	36.0							
	<u>HIGHLY WEATHERED SHALE</u> ; Olive-Gray to Dark Gray	39.0							
	<u>MODERATELY WEATHERED SHALE</u> ; With Occasional Gypsum Seams; Gray	45.0							
	BOTTOM OF BORING **Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.								

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.



* Calibrated Hand Penetrometer

N3BLGE 65018 3/14/96

WATER LEVEL OBSERVATIONS, Ft.						BORING STARTED		2-19-96		
WL	▽	12.5	WS	▽		13.5	AB	BORING COMPLETED		2-19-96
WL	▽			▽				RIG	CME 75	FOREMAN AT/MM
WL								APPROVED	JKH	JOB # 01965018

LOG OF BORING NO. B-11

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CLIENT Sedgwick County, Kansas			ARCHITECT/ENGINEER SJCF & Associates, PA							
SITE Wichita, Kansas			PROJECT Sedgwick County Adult Detention Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF	
	Approx. Surface Elev.: 113.6 ft.									
	2 Inches Asphalt				PA					
	<u>LEAN TO FAT CLAY</u> ; Dark Brown to Brown; Very Stiff		CL-CH	1	SS	18	12	23.0		6500*
					PA					LL = 51 PL = 19 PI = 32
		5.0								
		108.6								
	<u>SILTY FINE SAND</u> ; Brown; Loose to Medium Dense		SM	2	SS	18	8	3.9		
					PA					
		10.5								
		103.1								
	<u>FINE TO COARSE SAND</u> , Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose		SW	3	SS	18	7	15.9		2000*
		13.5								
		100.1								
	BOTTOM OF BORING									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	▽	NONE	WD	▽	NONE	AB
WL	▽		WD	▽		
WL						

Terracon

BORING STARTED 2-20-96

BORING COMPLETED 2-20-96

RIG CME 75 FOREMAN AT/MM

APPROVED JKH JOB # 01965018

LOG OF BORING NO. B-12

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CLIENT Sedgwick County, Kansas		ARCHITECT/ENGINEER SJCF & Associates, PA							
SITE Wichita, Kansas		PROJECT Sedgwick County Adult Detention Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF
	Approx. Surface Elev.: 113.2 ft.								
	2 Inches Asphalt			HS					
	<u>LEAN TO FAT CLAY</u> ; Dark Brown to Brown; Very Stiff		CL-CH	1	SS	18	11	25.4	3500*
	4.0 109.2			HS					
	<u>SILTY FINE SAND</u> ; Brown; Medium Dense	5							
		10							
	11.5 101.7		SW	2	SS	18	11	13.0	
	<u>FINE TO COARSE SAND</u> , Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose to Medium Dense	15			HS				
		20							
	21.5 91.7		SP	3	SS	18	10	10.8	
	<u>MEDIUM TO COARSE SAND</u> , Trace Gravel and Silt; Gray-Brown; Medium Dense	25			HS				
Continued Next Page									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	▽	12.0	WS	▽	12.0	AB
WL	▽		WS	▽		
WL						

Terracon

BORING STARTED	2-19-96
BORING COMPLETED	2-19-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

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Sedgwick County, Kansas

SJCF & Associates, PA

Wichita, Kansas

Sedgwick County Adult Detention Facility

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* Calibrated Hand Penetrometer

Terracon

BORING STARTED		2-19-96
BORING COMPLETED		2-19-96
RIG	CME 75	FOREMAN AT/MM
APPROVED	JKH	JOB # 01965018

V3BLGE 65018 3/14/96

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ARCHITECT/ENGINEER
SJCF & Associates, PA

PROJECT
Sedgwick County Adult Detention Facility

V3BLGE 65018 3/14/96

* Calibrated Hand Penetrometer

Terracon

LOG OF BORING NO. B-13

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CLIENT Sedgwick County, Kansas				ARCHITECT/ENGINEER SJCF & Associates, PA			
SITE Wichita, Kansas				PROJECT Sedgwick County Adult Detention Facility			
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES			TESTS
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.
	Approx. Surface Elev.: 113.4 ft.						
	2 Inches Asphalt				PA		
	<u>LEAN TO FAT CLAY</u> ; Dark Brown to Brown; Very Stiff		CL	1	SS	18	10
							27.7
							4000*
		4.5			PA		
		108.9					
	<u>LEAN CLAY WITH FINE SAND</u> ; Brown to Dark Brown; Stiff						
		6.5					
		106.9					
	<u>SILTY FINE SAND</u> ; Brown; Medium Dense		SM	2	SS	18	18
							5.6
					PA		
		11.5					
		101.9					
	<u>FINE TO COARSE SAND</u> , Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose to Medium Dense		SW	3	SS	18	16
							6.7
					PA		
		15					
		20					
		25					

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	▽	14.0	WD	▽	12.5	AB
WL	▽		WD	▽		
WL						

Terracon

BORING STARTED	2-19-96
BORING COMPLETED	2-19-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

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ARCHITECT/ENGINEER
SJCF & Associates, PA

PROJECT
Sedgwick County Adult Detention Facility

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

BORING STARTED		2-19-96
BORING COMPLETED		2-19-96
RIG	CME 75	FOREMAN AT/MM
APPROVED	JKH	JOB # 01965018

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Sedgwick County, Kansas

SJCF & Associates, PA

Wichita, Kansas

Sedgwick County Adult Detention Facility

Continued Next Page

* Calibrated Hand Penetrometer


Terracon

BORING STARTED		2-21-96
BORING COMPLETED		2-21-96
RIG	CME 75	FOREMAN AT/MM
APPROVED	JKH	JOB # 01965018

N3BLGE 65018 3/14/96

LOG OF BORING NO. B-14

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CLIENT		ARCHITECT/ENGINEER							
Sedgwick County, Kansas		SJCF & Associates, PA							
SITE		PROJECT							
Wichita, Kansas		Sedgwick County Adult Detention Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF
	<u>FINE TO COARSE SAND</u> , Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose to Medium Dense	27.0							
		87.2	SP	3	SS	18	15	19.0	
	<u>FINE TO MEDIUM SAND</u> , Trace Silt; Brown; Medium Dense				HS				
		30							
		35							
		36.0							
	78.2								
	<u>HIGHLY WEATHERED SHALE</u> ; Olive-Gray to Dark Gray	37.0							
		77.2		4	SS	18	65	26.0	9000*
	<u>MODERATELY WEATHERED SHALE</u> ; With Occasional Gypsum Seams; Gray				HS				
		40							
		45							
	46.0								
	68.2								
	<u>SLIGHTLY WEATHERED SHALE</u> ; With Numerous Gypsum; Gray			5	SS	5	50/5"	40.9	
				HS					
		50							

Continued Next Page

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

* Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

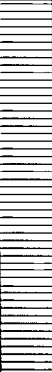
WL	▽	12.0	WD	▽	15.0	AB
WL	▽		WD	▽		
WL						

Terracon

BORING STARTED	2-21-96
BORING COMPLETED	2-21-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

LOG OF BORING NO. B-14

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CLIENT Sedgwick County, Kansas				ARCHITECT/ENGINEER SJCF & Associates, PA						
SITE Wichita, Kansas				PROJECT Sedgwick County Adult Detention Facility						
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH, PSF
	<u>SLIGHTLY WEATHERED SHALE;</u> With Numerous Gypsum; Gray	55								
58.0		56.2		6	SS	12	50/6"	30.7		6000*
BOTTOM OF BORING										
**Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.:

WL	▽	12.0	WD	▽	15.0	AB
WL	▽		WD	▽		
WL						



Terracon

BORING STARTED	2-21-96
BORING COMPLETED	2-21-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

N3BLGE 65018 3/14/96

LOG OF BORING NO. B-15

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CLIENT		ARCHITECT/ENGINEER							
Sedgwick County, Kansas		SJCF & Associates, PA							
SITE		PROJECT							
Wichita, Kansas		Sedgwick County Adult Detention Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF
	Approx. Surface Elev.: 114.1 ft.								
	5 Inches Asphalt			PA					
	<u>LEAN TO FAT CLAY</u> ; Dark Brown to Brown; Very Stiff		CL-CH	1	SS	18	10	21.1	3000*
					PA				
5.5	108.6	5							
	<u>FINE TO MEDIUM SAND</u> , Trace Silt; Brown; Loose		SP	2	SS	18	5	4.7	
	Becoming Medium Dense Below 11 Feet				PA				
			10						
13.5	100.6		SP	3	SS	18	17	7.7	
	BOTTOM OF BORING								

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	▽	12.0	WS	▽	12.0	AB
WL	▽		WS	▽		
WL						

Terracon

BORING STARTED	2-21-96
BORING COMPLETED	2-21-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

N3BLGE 65018 3/14/96

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ARCHITECT/ENGINEER
SJCF & Associates, PA

PROJECT
Sedgwick County Adult Detention Facility

Continued Next Page

* Calibrated Hand Penetrometer

BORING STARTED		2-22-96
BORING COMPLETED		2-22-96
RIG	CME 75	FOREMAN AT/MM
APPROVED	JKH	JOB # 01965018

N3BLGE 65018 3/14/96

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Sedgwick County, Kansas

SJCF & Associates, PA

Wichita, Kansas

Sedgwick County Adult Detention Facility

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Terracon

N3BLGE 65018 3/14/96

LOG OF BORING NO. B-17

Page 1 of 1

CLIENT Sedgwick County, Kansas			ARCHITECT/ENGINEER SJCF & Associates, PA						
SITE Wichita, Kansas			PROJECT Sedgwick County Adult Detention Facility						
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, IN. SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH, PSF
	Approx. Surface Elev.: 114.3 ft.								
	4 Inches Asphalt				PA				
	<u>FILL: LEAN CLAY</u> , Trace Sand and Gravel; Dark Brown to Brown 111.8		CL	1	SS	18 3	23.0		1500*
	<u>LEAN CLAY WITH FINE SAND</u> ; Brown to Dark Brown; Stiff				PA				
	6.0 108.3	5							
	<u>SILTY FINE SAND WITH SILT AND CLAY SEAMS</u> ; Brown; Loose		SM	2	SS	18 5	8.5		
	11.5 102.8	10			PA				
	<u>FINE TO COARSE SAND</u> , Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose to Medium Dense 100.8		SW	3	SS	18 11	5.8		
	BOTTOM OF BORING								

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

* Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	▽	NONE	WD	▽	NONE	AB
WL	▽		WD	▽		
WL						




Terracon

BORING STARTED	2-21-96
BORING COMPLETED	2-21-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

N3BLGE 65018 3/14/96

LOG OF BORING NO. B-18

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CLIENT Sedgwick County, Kansas		ARCHITECT/ENGINEER SJCF & Associates, PA							
SITE Wichita, Kansas		PROJECT Sedgwick County Adult Detention Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF
	Approx. Surface Elev.: 114.1 ft.								
	9 Inches Asphalt			PA					
	<u>LEAN CLAY WITH FINE SAND</u> ; Brown to Dark Brown; Stiff		CL	1	SS	18	7	15.0	6500*
					PA				
		5							
	7.0	107.1							
	<u>FINE TO MEDIUM SAND WITH CLAY SEAMS</u> , Trace Silt; Brown; Loose With Gravel Below 11 Feet		SP	2	SS	18	6	6.3	
					PA				
		10							
			SP	3	SS	18	6	9.3	
				PA					
		15							
		20							
	21.0	93.1							
	<u>FINE TO COARSE SAND</u> , Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose to Medium Dense								
		25							

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	▽	12.0	WS	▽	13.0	AB
WL	▽			▽		
WL						

Terracon

BORING STARTED 2-20-96

BORING COMPLETED 2-20-96

RIG CME 75 FOREMAN AT/MM

APPROVED JKH JOB # 01965018

N3BL0E 65018 3/14/96

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Sedgwick County, Kansas

SJCF & Associates, PA

Wichita, Kansas

Sedgwick County Adult Detention Facility

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WL	∇	12.0	WS	∇	13.0	AB
WL	∇			∇		
WL						

BORING STARTED		2-20-96
BORING COMPLETED		2-20-96
RIG	CME 75	FOREMAN AT/MM
APPROVED	JKH	JOB # 01965018

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Sedgwick County, Kansas

SJCF & Associates, PA

Wichita, Kansas

Sedgwick County Adult Detention Facility

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* Calibrated Hand Penetrometer

Terracon

BORING STARTED		2-22-96
BORING COMPLETED		2-22-96
RIG	CME 75	FOREMAN AT/MM
APPROVED	JKH	JOB # 01965018

N3BLGE 65018 3/14/96

LOG OF BORING NO. B-19

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CLIENT Sedgwick County, Kansas				ARCHITECT/ENGINEER SJCF & Associates, PA						
SITE Wichita, Kansas				PROJECT Sedgwick County Adult Detention Facility						
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES			TESTS			
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH, PSF
	26.0 87.9 MEDIUM TO COARSE SAND, Trace Gravel and Silt; Gray-Brown; Medium Dense	26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	SP	3	SS	18	9	9.6		
					HS					
	37.0 76.9 HIGHLY WEATHERED SHALE; Olive-Gray to Dark Gray	37 38 39 40 41 42 43 44 45 46 47 48 49 50		4	SS	18	23	29.1	8000*	
					HS					
	46.0 67.9 MODERATELY WEATHERED SHALE; With Occasional Gypsum Seams; Gray	46 47 48 49 50		5	SS	18	53	27.3	7500*	
					HS					

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.


WL	▽	13.0	WD	▽	14.0	AB
WL	▽		WD	▽		
WL						

Terracon

BORING STARTED		2-22-96
BORING COMPLETED		2-22-96
RIG	CME 75	FOREMAN AT/MM
APPROVED	JKH	JOB # 01965018

LOG OF BORING NO. B-19

Page 3 of 3

CLIENT Sedgwick County, Kansas				ARCHITECT/ENGINEER SJCF & Associates, PA						
SITE Wichita, Kansas				PROJECT Sedgwick County Adult Detention Facility						
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES			TESTS			
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH, PSF
	MODERATELY WEATHERED SHALE; With Occasional Gypsum Seams; Gray	55 								

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

* Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.				
WL	▽	13.0	WD	▽ 14.0 AB
WL	▽		WD	▽
WL				

Terracon

BORING STARTED	2-22-96
BORING COMPLETED	2-22-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

N3BLGE 65018 3/14/96

LOG OF BORING NO. B-20

Page 1 of 1

CLIENT Sedgwick County, Kansas		ARCHITECT/ENGINEER SJCF & Associates, PA	
SITE Wichita, Kansas		PROJECT Sedgwick County Adult Detention Facility	
GRAPHIC LOG	DESCRIPTION	SAMPLES	
		DEPTH (FT.)	USCS SYMBOL
	Approx. Surface Elev.: 113.7 ft.		
	5 Inches Asphalt		PA
	2.0 FILL: LEAN CLAY WITH SAND, GRAVEL, AND BRICK; Dark Brown 111.7	CL-CH	1 SS 18 8 13.4 5000*
	LEAN TO FAT CLAY; Dark Brown to Brown; Very Stiff		PA
	4.5 109.2		
	SILTY FINE SAND; Brown; Medium Dense		
		SM	2 SS 18 12 5.5
			PA
	11.5 102.2		
	13.5 FINE TO COARSE SAND, Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose 100.2	SW	3 SS 18 6 5.4
	BOTTOM OF BORING		

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

* Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	▽	NONE	WD	▽	NONE	AB
WL	▽		WD	▽		
WL						

Terracon

BORING STARTED	2-21-96
BORING COMPLETED	2-21-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

N3BLGE 65018 3/14/96

LOG OF BORING NO. B-21

Page 1 of 2

CLIENT		ARCHITECT/ENGINEER							
Sedgwick County, Kansas		SJCF & Associates, PA							
SITE		PROJECT							
Wichita, Kansas		Sedgwick County Adult Detention Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES				TESTS	
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF
	Approx. Surface Elev.: 113.5 ft.								
	4 Inches Asphalt			PA					
	2.5 <u>FILL: LEAN CLAY WITH SAND, GRAVEL, AND BRICK;</u> Dark Brown 111.0		CL-CH	1	SS	18	11	16.1	3500*
	<u>LEAN TO FAT CLAY;</u> Dark Brown to Brown; Very Stiff			PA					
	7.0 106.5	5							
	<u>SILTY FINE SAND,</u> Trace Gravel and Clay Seams; Brown; Medium Dense		SM	2	SS	18	10	7.4	
	11.0 102.5	10		PA					
	<u>FINE TO COARSE SAND,</u> Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose		SW	3	SS	18	7	9.6	
		15		PA					
		20							
		25							

Continued Next Page

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

N38LGE 65018 3/14/96

WATER LEVEL OBSERVATIONS, Ft.				BORING STARTED 2-22-96	
WL	▽	12.0	WS	▽	12.0 AB
WL	▽		WS	▽	
WL	▽		WS	▽	
				BORING COMPLETED 2-22-96	
				RIG CME 75	FOREMAN AT/MM
				APPROVED JKH	JOB # 01965018

Page 2 of 2

Sedgwick County, Kansas

SJCF & Associates, PA

Wichita, Kansas

Sedgwick County Adult Detention Facility

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WL	∇	12.0	WS	∇	12.0	AB
WL	∇			∇		
WL						

BORING STARTED		2-22-96
BORING COMPLETED		2-22-96
RIG	CME 75	FOREMAN AT/MM
APPROVED	JKH	JOB # 01965018

V38LGE 65018 3/14/96

Page 1 of 2

ARCHITECT/ENGINEER
SJCF & Associates, PA

PROJECT
Sedgwick County Adult Detention Facility

Continued Next Page

* Calibrated Hand Penetrometer

BORING STARTED		2-20-96
BORING COMPLETED		2-20-96
RIG	CME 75	FOREMAN AT/MM
APPROVED	JKH	JOB # 01965018

W38LGE 65018 3/14/96

LOG OF BORING NO. B-22

Page 2 of 2

CLIENT Sedgwick County, Kansas		ARCHITECT/ENGINEER SJCF & Associates, PA							
SITE Wichita, Kansas		PROJECT Sedgwick County Adult Detention Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES				TESTS	
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF
	<u>FINE TO COARSE SAND</u> , Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose to Medium Dense								
		30							
		35							
		36.5							
		76.3							
	<u>HIGHLY WEATHERED SHALE</u> ; Olive-Gray to Dark Gray								
		40							
		43.0							
	<u>MODERATELY WEATHERED SHALE</u> ; With Occasional Gypsum Seams; Gray	69.8							
		44.0							
	<u>SLIGHTLY WEATHERED SHALE</u> ; With Numerous Gypsum; Gray	68.8							
		45.0							
		67.8							
	BOTTOM OF BORING								
	**Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.								

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

* Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	▽	12.0	WS	▽	12.5	AB
WL	▽		WS	▽		
WL						

Terracon

BORING STARTED	2-20-96
BORING COMPLETED	2-20-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

LOG OF BORING NO. B-23

Page 1 of 2

CLIENT Sedgwick County, Kansas		ARCHITECT/ENGINEER SJCF & Associates, PA	
SITE Wichita, Kansas		PROJECT Sedgwick County Adult Detention Facility	

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF
	Approx. Surface Elev.: 112.9 ft.								
	4 Inches Asphalt				PA				
	<u>LEAN CLAY WITH FINE SAND</u> ; Brown to Dark Brown; Stiff		CH	1	SS	18	7	15.9	3000*
					PA				
	5.0 107.9	5							
	<u>SILTY FINE SAND</u> ; Brown; Medium Dense		SM	2	SS	18	16	5.0	
					PA				
	12.0 100.9	10							
	<u>FINE TO COARSE SAND</u> , Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose to Medium Dense		SW	3	SS	18	11	7.2	
					PA				
		15							
		20							
		25							

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

* Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	▽	12.0	WS	▽	13.5	AB
WL	▽		WS	▽		
WL						

Terracon

BORING STARTED	2-20-96
BORING COMPLETED	2-20-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

LOG OF BORING NO. B-23

Page 2 of 2

CLIENT Sedgwick County, Kansas				ARCHITECT/ENGINEER SJCF & Associates, PA			
SITE Wichita, Kansas				PROJECT Sedgwick County Adult Detention Facility			
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES			TESTS
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.
	<u>FINE TO COARSE SAND</u> , Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose to Medium Dense						
		30					
		35					
		36.0					
		76.9					
	<u>HIGHLY WEATHERED SHALE</u> ; Olive-Gray to Dark Gray						
		40.0					
		72.9					
	<u>MODERATELY WEATHERED SHALE</u> ; With Occasional Gypsum Seams; Gray						
		44.0					
		68.9					
	<u>SLIGHTLY WEATHERED SHALE</u> ; With Numerous Gypsum; Gray						
		45.0					
		67.9					
	BOTTOM OF BORING						
	**Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.						

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

* Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	▽	12.0	WS	▽	13.5	AB
WL	▽		WS	▽		
WL						

Terracon







BORING STARTED		2-20-96
BORING COMPLETED		2-20-96
RIG	CME 75	FOREMAN AT/MM
APPROVED	JKH	JOB # 01965018

N3BLGE 65018 3/14/96

LOG OF BORING NO. B-24

Page 1 of 2

CLIENT Sedgwick County, Kansas	ARCHITECT/ENGINEER SJCF & Associates, PA
SITE Wichita, Kansas	PROJECT Sedgwick County Adult Detention Facility

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH, PSF
	Approx. Surface Elev.: 112.5 ft.									
	<u>FILL: LEAN CLAY WITH SAND, GRAVEL, AND BRICK</u> ; Dark Brown	110.5			PA					
	<u>LEAN CLAY WITH FINE SAND</u> ; Brown to Dark Brown; Stiff		CL	1	SS	18	5	15.3		2000*
					PA					
		6.0								
	<u>SILTY FINE SAND WITH CLAY SEAMS</u> , Trace Gravel; Brown; Loose	106.5			PA					
			SM	2	SS	18	4	5.2		
					PA					
		11.0								
	<u>FINE TO MEDIUM SAND</u> , Trace Silt; ▽ Brown; Loose ▼	101.5			PA					
			SP	3	SS	18	5	8.5		
					PA					

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	▽	12.0	WS	▽	13.0	AB
WL	▽		WS	▽		
WL						


Terracon

BORING STARTED		2-22-96
BORING COMPLETED		2-22-96
RIG	CME 75	FOREMAN AT/MM
APPROVED	JKH	JOB # 01965018

N3BLGE 65018 3/14/96

LOG OF BORING NO. B-24

Page 2 of 2

CLIENT Sedgwick County, Kansas				ARCHITECT/ENGINEER SJCF & Associates, PA			
SITE Wichita, Kansas				PROJECT Sedgwick County Adult Detention Facility			
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES			TESTS
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.
	<u>FINE TO MEDIUM SAND</u> , Trace Silt; Brown; Medium Dense	35.5	77.0				
	<u>HIGHLY WEATHERED SHALE</u> ; Olive-Gray to Dark Gray	40.0	72.5				
	<u>MODERATELY WEATHERED SHALE</u> ; With Occasional Gypsum Seams; Gray	45.0	67.5				
	BOTTOM OF BORING **Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.						

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

* Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	▽	12.0	WS	▽	13.0	AB
WL	▽		WS	▽		
WL						

Terracon

BORING STARTED	2-22-96
BORING COMPLETED	2-22-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

N3BLGE 95018 3/14/96

Page 1 of 2

Sedgwick County, Kansas

SJCF & Associates, PA

Wichita, Kansas

Sedgwick County Adult Detention Facility

Continued Next Page

* Calibrated Hand Penetrometer

Terracon

BORING STARTED		2-22-96
BORING COMPLETED		2-22-96
RIG	CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018	

N3BLGE 65018 3/14/96

LOG OF BORING NO. B-25

Page 2 of 2

CLIENT Sedgwick County, Kansas		ARCHITECT/ENGINEER SJCF & Associates, PA							
SITE Wichita, Kansas		PROJECT Sedgwick County Adult Detention Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES				TESTS	
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF
	<u>MEDIUM TO COARSE SAND</u> , Trace Gravel and Silt; Gray-Brown; Medium Dense	30							
	35.0 77.7	35							
	<u>HIGHLY WEATHERED SHALE</u> ; Olive-Gray to Dark Gray	40							
	43.0 69.7								
	<u>MODERATELY WEATHERED SHALE</u> ; With Occasional Gypsum Seams; Gray	45							
	45.0 67.7								
	BOTTOM OF BORING								
	**Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.								

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.				
WL	▽	12.0	WS	▽
WL	▽		WS	▽
WL	▽		WS	▽




Terracon

BORING STARTED	2-22-96
BORING COMPLETED	2-22-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

N3BLGE 65018 3/14/96

LOG OF BORING NO. B-26

Page 1 of 2

CLIENT			ARCHITECT/ENGINEER							
Sedgwick County, Kansas			SJCF & Associates, PA							
SITE			PROJECT							
Wichita, Kansas			Sedgwick County Adult Detention Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH, PSF
	Approx. Surface Elev.: 114.2 ft.									
	5 Inches Concrete				PA					
	<u>LEAN TO FAT CLAY</u> ; Dark Brown to Brown; Very Stiff	3.0 111.2	CL	1	SS	18	11	26.5		4500*
	<u>LEAN CLAY WITH FINE SAND</u> ; Brown to Dark Brown; Stiff	6.0 108.2			PA					
	<u>SILTY FINE SAND</u> ; Brown; Medium Dense	10.5 103.7	SM	2	SS	18	17	8.6		
	<u>FINE TO COARSE SAND</u> , Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose to Medium Dense		SW	3	SS	18	11	6.7		
					PA					

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

* Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	▽	12.0	WS	▽	13.0	AB
WL	▽		WS	▽		
WL						

Terracon

BORING STARTED	2-22-96
BORING COMPLETED	2-22-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018

LOG OF BORING NO. B-26

Page 2 of 2

CLIENT Sedgwick County, Kansas		ARCHITECT/ENGINEER SJCF & Associates, PA							
SITE Wichita, Kansas		PROJECT Sedgwick County Adult Detention Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES				TESTS	
				NUMBER	TYPE	RECOVERY, IN.	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF
	<u>FINE TO COARSE SAND</u> , Trace Silt, and Gravel With Clay Seams; Brown to Gray-Brown; Loose to Medium Dense								
		30							
		35							
		37.5							
		76.7							
	<u>HIGHLY WEATHERED SHALE</u> ; Olive-Gray to Dark Gray								
		40							
		44.0							
		70.2							
	<u>SLIGHTLY WEATHERED SHALE</u> ; With Numerous Gypsum; Gray								
		45.0							
		69.2							
	BOTTOM OF BORING								
	**Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.								

The stratification lines represent the approximate boundary lines between soil and rock types; in-situ, the transition may be gradual.

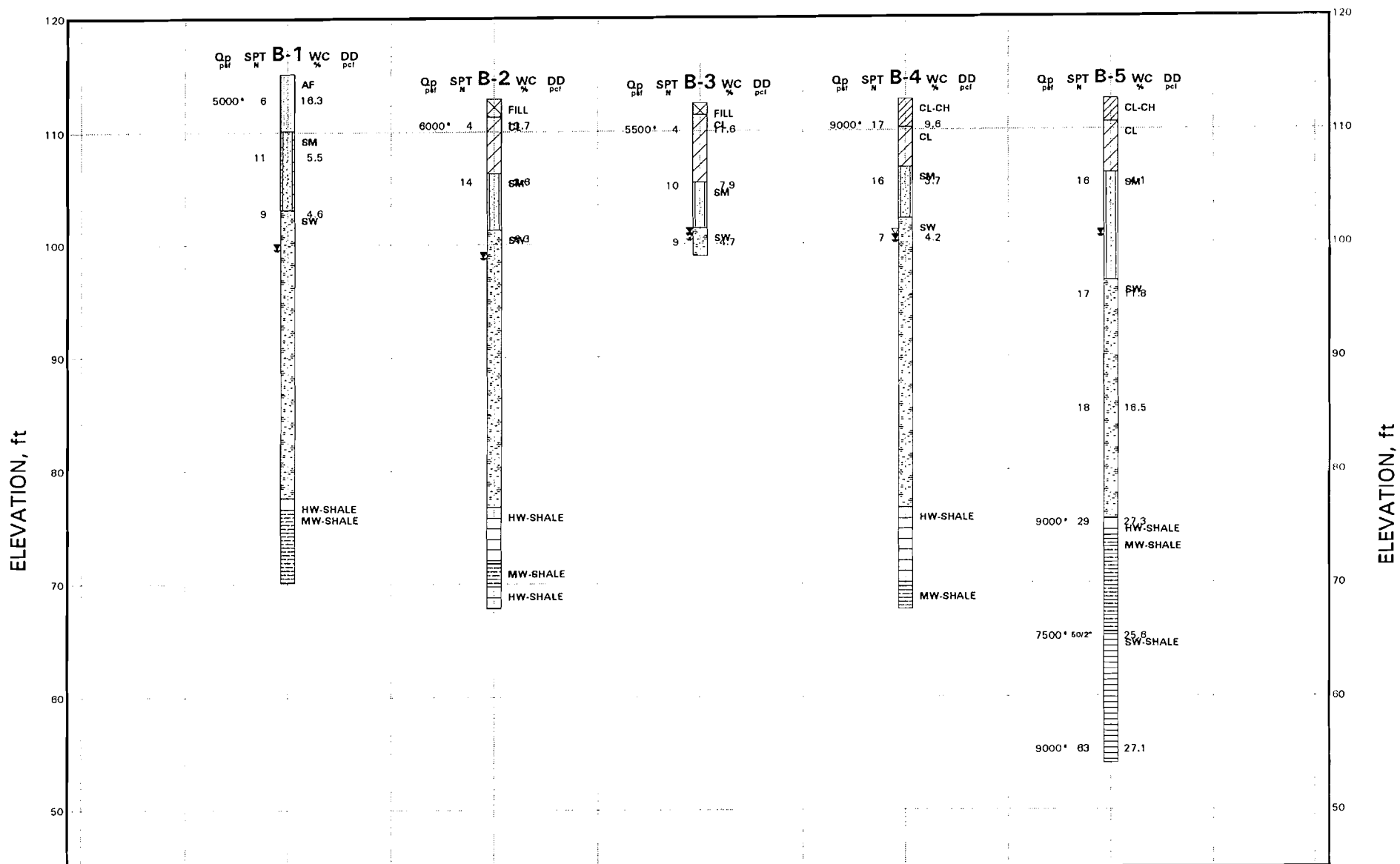
* Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, Ft.

WL	▽	12.0	WS	▽	13.0	AB
WL	▽		WS	▽		
WL						

Terracon

BORING STARTED	2-22-96
BORING COMPLETED	2-22-96
RIG CME 75	FOREMAN AT/MM
APPROVED JKH	JOB # 01965018



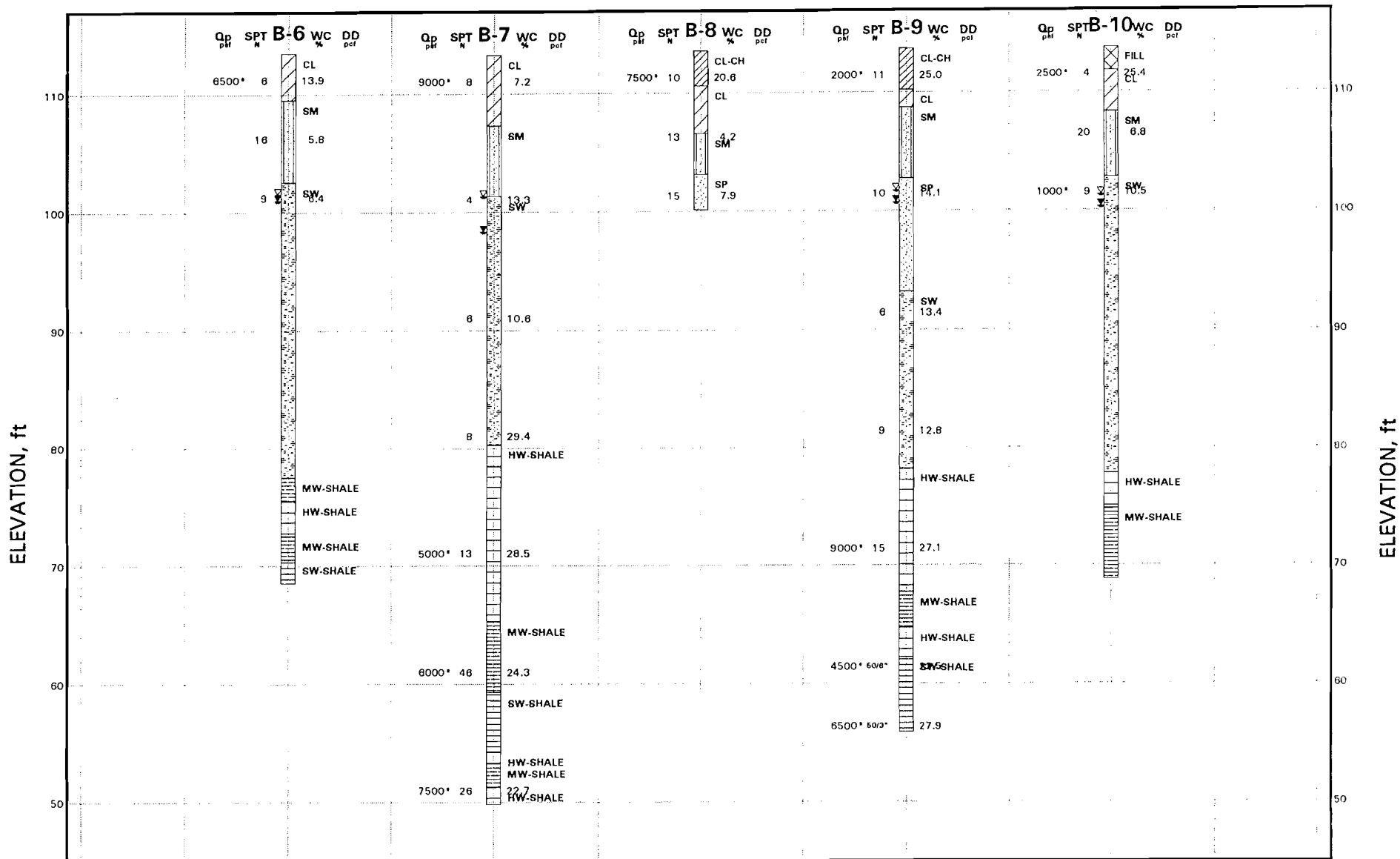
SUBSURFACE FENCE DIAGRAM

Boring Log Profile (B-1 to B-5)
Sedgwick County Adult Detention Facility

Wichita, Kansas

Project No.: 01965018
Date: April 8, 1996

Terracon



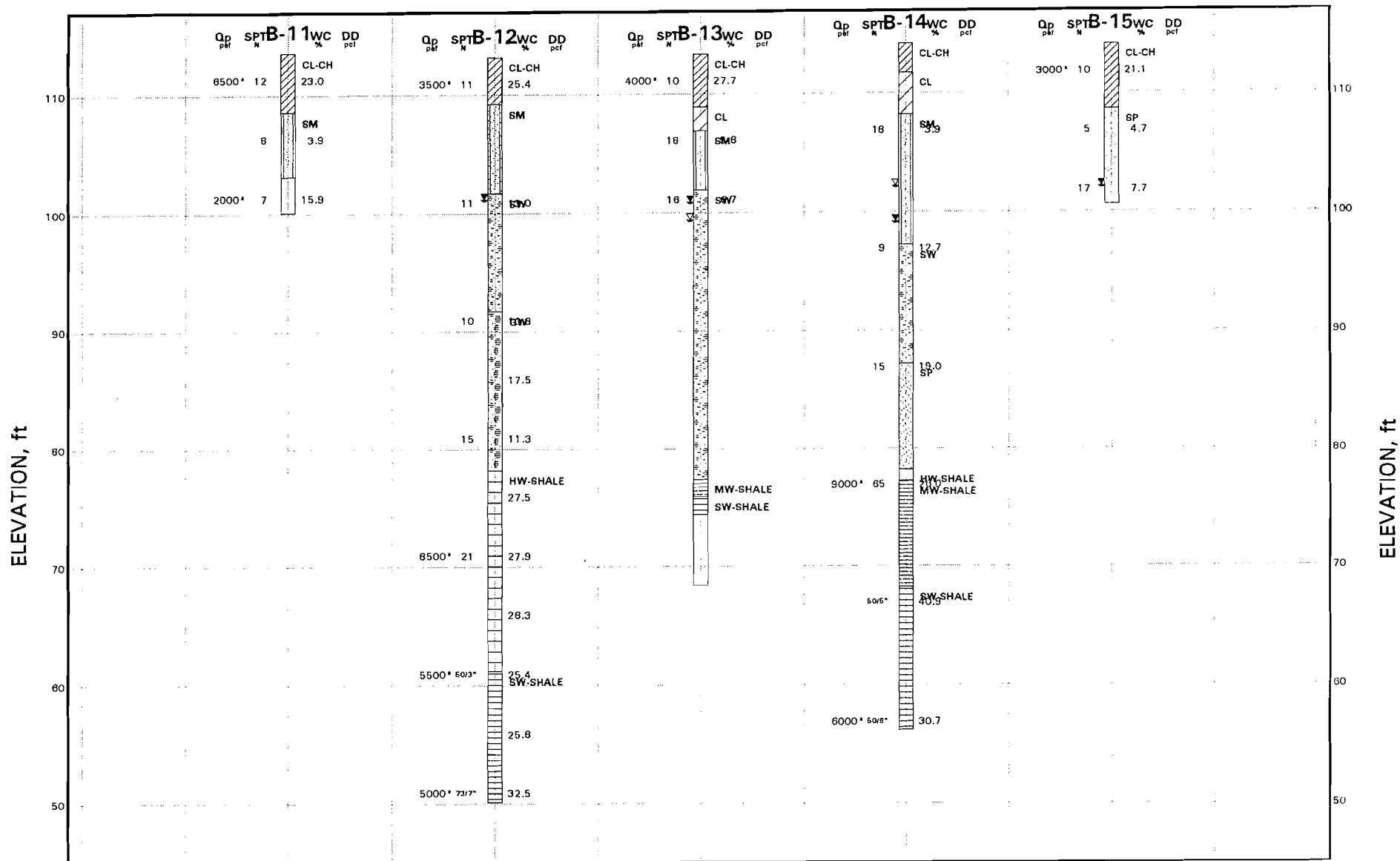
SUBSURFACE FENCE DIAGRAM

Project No.: 01965018
Date: March 23, 1996

Boring Log Profile (B-6 to B-10)
Sedgwick County Adult Detention Facility

Wichita, Kansas

Terracon



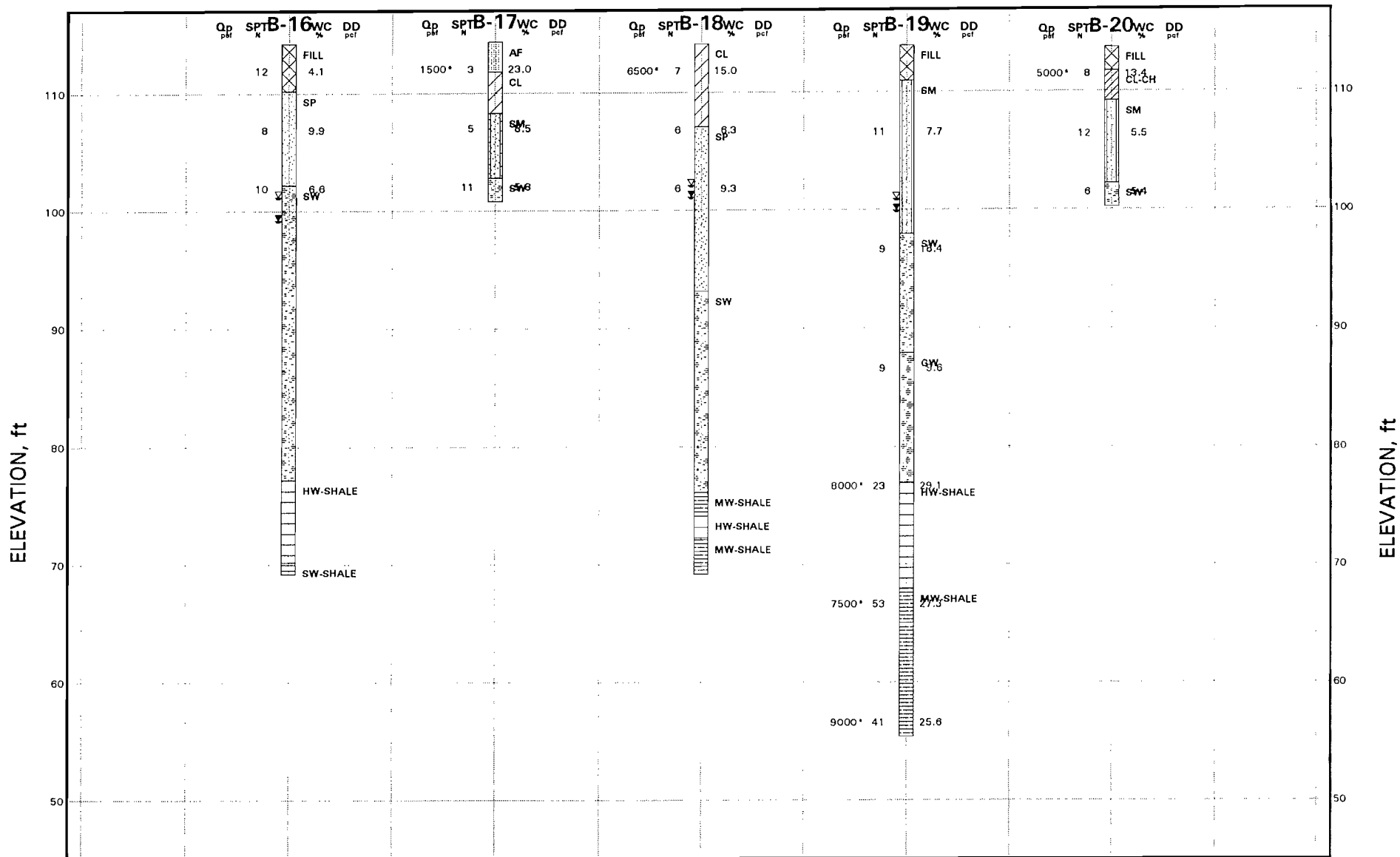
SUBSURFACE FENCE DIAGRAM

Project No.: 01965018
Date: March 23, 1996

Boring Log Profile (B-11 to B-15)
Sedgwick County Adult Detention Facility

Wichita, Kansas

Terracon



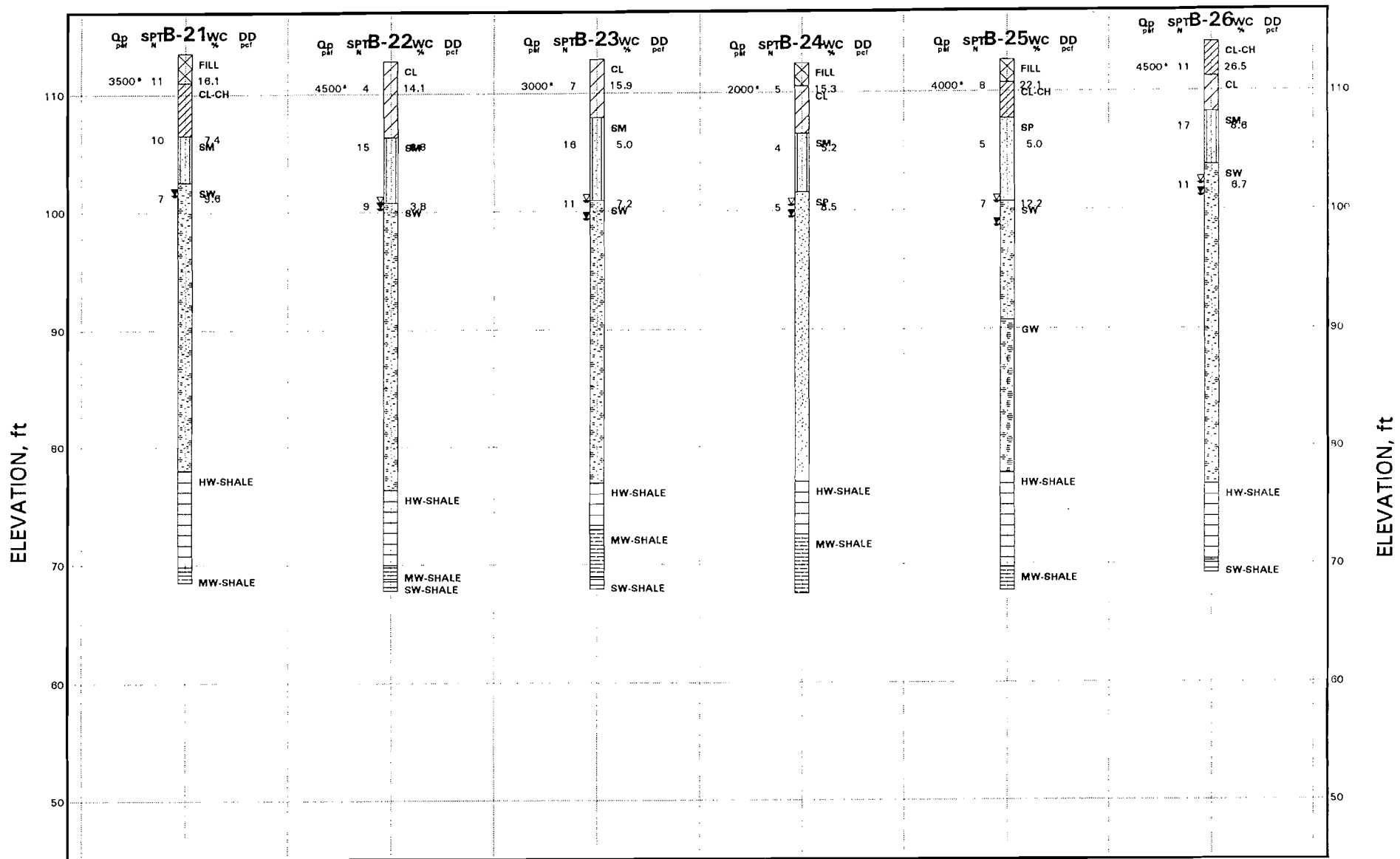
SUBSURFACE FENCE DIAGRAM

Project No.: 01965018
Date: March 23, 1996

Boring Log Profile (B-16 to B-20)
Sedgwick County Adult Detention Facility

Wichita, Kansas

Terracon



SUBSURFACE FENCE DIAGRAM

Project No.: 01965018
Date: March 23, 1996

Boring Log Profile (B-21 to B-26)
Sedgwick County Adult Detention Facility

Wichita, Kansas

Terracon

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests^A

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A				Soil Classification	
				Group Symbol	Group Name ^B
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines ^C	$Cu \geq 4$ and $1 \leq Cc \leq 3^E$	GW	Well-graded gravel ^F
			$Cu < 4$ and/or $1 > Cc > 3^E$	GP	Poorly graded gravel ^F
		Gravels with Fines More than 12% fines ^C	Fines classify as ML or MH	GM	Silty gravel ^{F, G, H}
			Fines classify as CL or CH	GC	Clayey gravel ^{F, G, H}
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines ^E	$Cu \geq 6$ and $1 \leq Cc \leq 3^E$	SW	Well-graded sand ^I
			$Cu < 6$ and/or $1 > Cc > 3^E$	SP	Poorly graded sand ^I
		Sands with Fines More than 12% fines ^D	Fines classify as ML or MH	SM	Silty sand ^{G, H, I}
			Fines classify as CL or CH	SC	Clayey sand ^{G, H, I}
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	$PI > 7$ and plots on or above "A" line ^J	CL	Lean clay ^{K, L, M}
			$PI < 4$ or plots below "A" line ^J	ML	Silt ^{K, L, M}
		organic	$\frac{\text{Liquid limit — oven dried}}{\text{Liquid limit — not dried}} < 0.75$	OL	Organic clay ^{K, L, M, N}
					Organic silt ^{K, L, M, O}
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay ^{K, L, M}
			PI plots below "A" line	MH	Elastic silt ^{K, L, M}
		organic	$\frac{\text{Liquid limit — oven dried}}{\text{Liquid limit — not dried}} < 0.75$	OH	Organic clay ^{K, L, M, P}
					Organic silt ^{K, L, M, Q}
Highly organic soils	Primarily organic matter, dark in color, and organic odor			PT	Peat

^ABased on the material passing the 3-in. (75-mm) sieve.

^BIf field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^CGravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay

^DSands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

$$C_u = D_{60}/D_{10} \quad C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^FIf soil contains $\geq 15\%$ sand, add "with sand" to group name.

^GIf fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^HIf fines are organic, add "with organic fines" to group name.

^IIf soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^JIf Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^KIf soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel", whichever is predominant.

^LIf soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

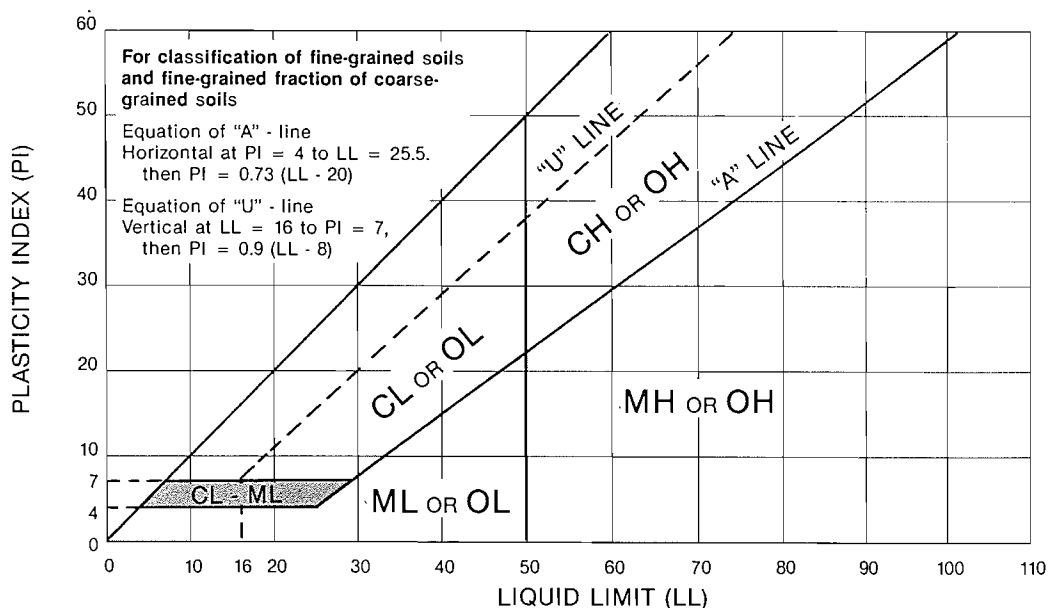
^MIf soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N $PI \geq 4$ and plots on or above "A" line.

^O $PI < 4$ or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.



Terracon

ACTIVE EARTH PRESSURE ON 1-FOOT WIDE VERTICAL STRIP

(WALL ROTATION OCCURRING)

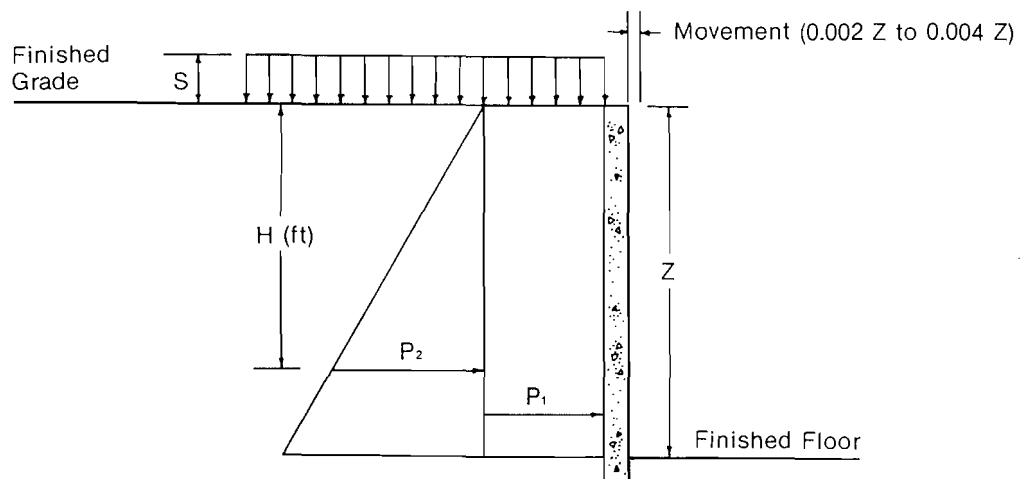
(Cohesive Soils)

S = Uniform surcharge at grade, load in psf

Z = Wall Height (ft)

$P_1 = .55 \times S$ = Effect of uniform surface surcharge

$P_2 = 60 \times H$ = Active earth pressure



CONDITIONS

- Coefficient of active earth pressure = 0.55
- Units of P_1 , P_2 in psf
- Horizontal backfill
- Lean to Fat Clay Backfill Compacted to 95 percent of standard Proctor maximum dry density
- In-situ soil weight = 110 pcf
- No safety factor included
- Uniform surcharge
- No ground water acting on wall
- Negligible wall friction
- Wall must rotate about base, with top lateral movements $0.002Z$ to $0.004Z$ where Z is wall height
- Loading from heavy compaction equipment not included

ACTIVE EARTH PRESSURE ON 1-FOOT WIDE VERTICAL STRIP

(WALL ROTATION OCCURRING)

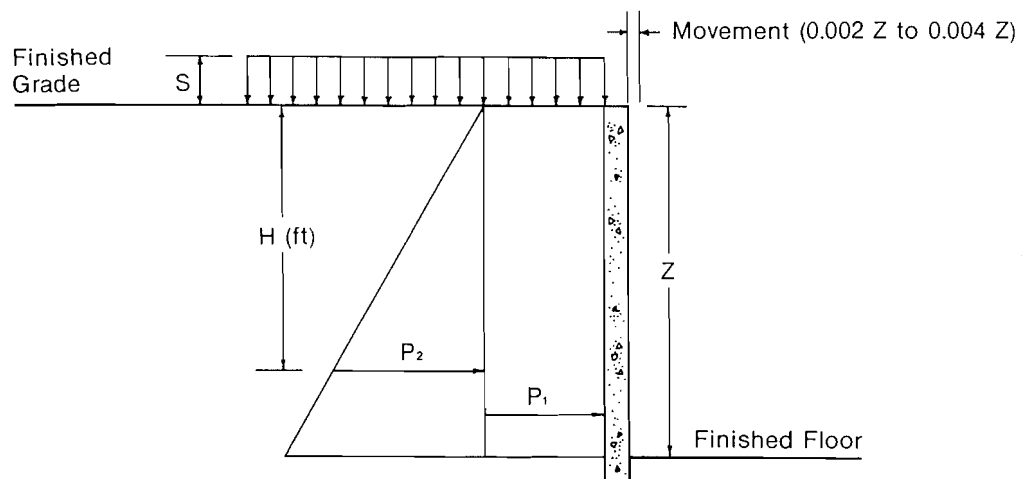
(Granular Soils)

S = Uniform surcharge at grade, load in psf

Z = Wall Height (ft)

$P_1 = .36 \times S$ = Effect of uniform surface surcharge

$P_2 = 40 \times H$ = Active earth pressure



CONDITIONS

- Coefficient of active earth pressure = 0.36
- Units of P_1 , P_2 in psf
- Horizontal backfill
- Granular Backfill Compacted to 95 percent of standard Proctor maximum dry density
- In-situ soil weight - 110 pcf
- No safety factor included
- Uniform surcharge
- No ground water acting on wall
- Negligible wall friction
- Wall must rotate about base, with top lateral movements $0.002Z$ to $0.004Z$ where Z is wall height
- Loading from heavy compaction equipment not included

SECTION 31 31 16 - TERMITE CONTROL**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Chemical soil treatment.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Vapor barrier placement under concrete slab-on-grade.

1.03 REFERENCE STANDARDS

- A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; 1947 (Revised 2001).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.
- C. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.
- D. Manufacturer's Application Instructions: Indicate caution requirements .
- E. Record and document date and rate of application, areas of application, and toxicant used.
- F. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing this type of work and:
 - 1. Having minimum of three (3) years experience.
 - 2. Licensed in Kansas.
 - a. Only trained and certified workers shall apply the termicide.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year installer's warranty against damage to building caused by termites.
 - 1. Include coverage for repairs to building and to contents damaged due to the infestation of termites during the warranty period. Repair damage and re-treat.

PART 2 PRODUCTS**2.01 CHEMICAL SOIL TREATMENT**

- A. Toxicant Chemical: EPA (Title 7, United States Code, 136 through 136y) approved; synthetically color dyed to permit visual identification of treated soil.
- B. Diluent: Recommended by toxicant manufacturer.
- C. Manufacturers, Non-Repellent Termiticide:
 - 1. Bayer Environmental Science Corp; Premise 75: www.backedbybayer.com/pest-management.
 - 2. BASF Corporation; Termidor: www.termidorhome.com.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Manufacturers, Repellent Termiticide:
 - 1. FMC Professional Solutions; Baseline: www.fmcprosolutions.com.

2. Syngenta Professional Products; Dermon MAX:
www.syngentaprofessionalproducts.com.
3. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.
- B. Do not apply toxicant during inclement weather.
- C. 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 within and around foundations.
- D. Verify final grading is complete.

3.02 APPLICATION - CHEMICAL TREATMENT

- A. Comply with requirements of U.S. EPA and applicable state and local codes.
- B. Spray apply toxicant in accordance with manufacturer's instructions.
- C. Toxicant type and location:
 1. Apply Repellent Termiticide under slabs-on-grade areas below a wood floor system.
 2. Apply Non-Repellent Termiticide or Repellent Termiticide to all areas indicated below.
 - a. Under slabs-on-grade and basement slabs including around plumbing pipes and electric conduit penetrating the slab.
 - b. At both sides of foundation wall including around plumbing pipes and electric conduit penetrating the foundation wall.
- D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.
 1. Toxicant may be applied before placing granular fill under slabs if recommended in writing by termiticide manufacturer.
- E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.
- F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.
- G. Re-treat disturbed treated soil with same toxicant as original treatment.
- H. Provide Contractor a work order or treatment ticket showing the toxicant used, quantity applied, area or location applied, date and applicator. Failure to comply with these items will be sufficient cause to retreat the area.
- I. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 PROTECTION

- A. Do not permit soil grading over treated work.

END OF SECTION

SECTION 31 63 16 - AUGER CAST GROUT PILES**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Machine augered shaft, placement of pressure injected grout and internal reinforcement.

1.02 RELATED REQUIREMENTS

- A. Section 03 20 00 - Concrete Reinforcing
- B. Section 03 30 00 - Cast-in-Place Concrete

1.03 REFERENCE STANDARDS

- A. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.
- B. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.
- C. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2015.
- D. ASTM C937 - Standard Specification for Grout Fluidifier for Preplaced-Aggregate Concrete; 2010.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Pre-Construction Manual: Compile documents to outline project implementation, including but not limited to the following:
 - 1. Employment resume of each of the supervisory personnel who will be active on this project for approval. Any change in personnel for these responsibilities shall be similarly requested and approved.
 - 2. A list of at least ten past successful installations of this type pile by this installer and insofar as possible, by the personnel listed.
 - 3. Full description of proposed materials, details, and methods of installation.
- C. Project Record Documents: Record actual locations of piles, pile diameter, and pile length. Accurately record the following on project record documents:
 - 1. Sizes, lengths, and locations of piles.
 - 2. Sequence of placement.
 - 3. Final base and top elevations.
 - 4. Deviation from indicated locations.
 - 5. Placement and configuration of reinforcement.
 - 6. Grout strength test reports.
- D. Shop Drawings: For concrete reinforcement detailing, fabricating, bending, supporting, and placing.
- E. Material Certificates: For the following, from manufacturer.
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Steel reinforcement and accessories.
- F. Mix Design: Submit proposed grout mix design.
- G. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements.
 - 1. Grout

H. Field Quality Control Reports:

1. Static Pile Test Reports: Submit within three days of completing each test.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of documented experience in the successful installation of Auger Cast Grout Piles. This experience shall also apply to the pile subcontractor's general supervisor, job supervisor, and the rig keyman who is in charge of the drilling and rate of auger withdrawal.
- B. Surveys and Field Records in accordance with FIELD QUALITY CONTROL paragraph.

1.07 JOB CONDITIONS:

- A. A soils investigation has been made and is bound with this Project Manual. The information on the underlying earth strata is indicative of soils conditions tested and may be used by the Contractor and Pile Installer at their discretion and is not guaranteed as factual.
- B. Safe load required by the design is 75 Kips per pile, except where noted otherwise on the Drawings.

PART 2 PRODUCTS**2.01 DESCRIPTION**

- A. Provide a cement base non-shrinkage mortar consisting of a mixture of portland cement, special pozzolan, grouting agent, sand and water so proportioned and mixed as to produce a mortar capable of maintaining the solids in suspension without appreciable water gain; yet, which may be pumped without difficulty and which will penetrate and fill any voids in the adjacent soils.

2.02 MATERIALS

- A. Concrete Grout: Provide grout with ultimate compressive strength of 4,000 psi (27.6 MPa) at 28 days, using materials as follows:
 1. Portland Cement: ASTM C150, Type I or Type II.
 2. Pozzolan: Fly ash or other approved material conforming to requirements of ASTM C618, Class F or C.
 3. Grout Fluidifier: 1, with expansion limited to 4 percent.
 4. Fine Aggregate: ASTM C 33, except that the gradation shall be well graded from fine to coarse, with fineness modulus between 1.4 and 3.4. All of the sand shall pass the No. 8, and 95% to 100% pass the No. 16 U.S. Standard square mesh sieves.
 - a. The fineness modulus is defined as the total divided by 100 of the cumulative percentages retained on U.S. Standard Sieve Nos. 16, 30, 50, and 100.
 5. Water: Fresh, clean, and free of deleterious salts, alkali, acids, and organic matter.
- B. Reinforcement: ASTM A615, Grade 60, deformed.
- C. Vertical Bar Alignment Devices: Locate along the length of each pile to properly locate the reinforcing in the center of the pile.

PART 3 EXECUTION**3.01 PREPARATION**

- A. Use placement method that will not cause damage to nearby structures.
- B. Notify adjacent and affected land owners and building occupants with 14 days notice before proceeding with the Work.

- C. Protect structures near the Work from damage.
- D. Prepare to place piles from excavated working elevation. Do not begin installation of pile location stakes until ground elevation at each pile location is at least 12 inches (305 mm) higher than required pile cutoff elevation, and not less than 6" below the top of pile caps.

3.02 INSTALLATION

- A. Perform work only under supervision of the approved personnel experienced in the installation of pressure grouted piling and as the Pile Inspector.
- B. Use only thoroughly clean and approved mixing and pumping equipment in the preparation and handling of the cement mortar.
- C. Measure grout materials by volume or weight as they are fed to the mixer. Time mixing to produce a homogenous mortar of the desired consistency. If there is a lapse in the operation of pumping, the mortar shall be re-circulated through the pump, or through the mixer drum or agitator and pump.
- D. Reinforce piles as shown. Use centering devices on pile reinforcing to properly position the reinforcing in the center of the pile.
- E. Grout approved excavations under pressure, through the auger shaft as the auger is being withdrawn, using the earth-filled auger to retain the shape of the hole. The rate of extraction of the auger will be determined by field conditions, but in no case shall it exceed three feet per minute unless, with the Pile Inspector's approval, a positive grout line pressure of 100 p.s.i. is maintained with a higher extraction rate.
- F. Except where otherwise specifically directed by supervising engineer, drill each pile hole and fill with grout in an uninterrupted operation.
- G. Place reinforcing steel in accordance with Section 03 20 00 immediately after placement of wet grout.
- H. Set tops of piles to elevations indicated. Clean mortar from pile reinforcing bars in preparation for placing pile cap concrete. Cut off in such a manner as to not damage the top of the pile or the reinforcing. "Dipping" of piles will not be permitted.
- I. Do not permit top of pile to deform to a mushroom shape.
- J. A pile shall not be installed within 12 hours of the installation of an adjacent pile in the same group. An adjacent pile is one within six pile diameters, center to center.

3.03 TOLERANCES

- A. Maximum Variation From Vertical: not more than 1 1/2% of the pile length.
- B. Maximum Variation From Design Top Elevation: 1 inches (25 mm).
- C. Maximum Out-of-Position: 2 inches (50 mm).
- D. Should piles be installed outside of the tolerance permitted, the Contractor shall be responsible for obtaining any required re-design, as approved by the Architect and Structural Engineer, and also for furnishing any required extra materials and labor. Payment for this work shall be made by the Contractor without additional cost to the Owner unless such re-design is necessitated by obstructions, as outlined in the following paragraph, in which case the Owner will reimburse the Contractor.
- E. Should any obstructions (including boulders or timbers) be encountered which prevent a pile from being installed to the proper depth and tolerance at the design location, cease work on that pile group until directions for corrective measures are received from the Architect.
- F. If a pile is abandoned because of obstructions at direction of the Pile Inspector and Architect withdraw the auger, filling the abandoned hole by reversing the auger and backfilling the hole unless other method individually approved. Payment for piles thus

partially completed and abandoned shall be made in accordance with PRICE AND PAYMENT PROCEDURES paragraph.

3.04 FIELD QUALITY CONTROL

- A. The General Contractor shall engage a **registered surveyor** to accurately locate and stake location of each pile after earthwork has been done in preparation for pile caps.
- B. The General Contractor shall provide a certified record in four copies jointly signed by him and the Pile Inspector. These records shall show the individual pile identification, and length of pile from cut-off to tip.
- C. Not sooner than 24 hours but within 5 days after placing of the last pile in a group, excavation for the pile cap shall take place and the in-place survey performed. A subsequent report shall be furnished to the Architect with an as-installed survey of all piling. This survey shall be made by the registered surveyor prior to placing the pile cap concrete, and shall establish that the piles in that group and the piles in the surrounding adjacent groups have been installed as specified.
- D. Pile installer shall make a minimum of one set of four 2" cube samples each day, while observed by the Pile Inspector, and have them tested for compressive strength. Test one cube at 7 days, two cubes at 28 days, and one cube at 90 days by a testing laboratory approved by the Architect with the cost of such testing to be paid for by the Pile Subcontractor.
- E. The General Contractor shall employ a Pile Inspector consultant to monitor the installation of the pressure grouted piles and perform tests to evaluate grout strength all in accordance with the project requirements.
- F. Pile Inspector to inspect materials, equipment, operations of installing the piles and determine actual length of individual piles based upon field conditions as required to produce the safe allowable capacity required by the design.
- G. The Pile Inspector will monitor pile load tests performed by the Pile Subcontractor.

3.05 UNACCEPTABLE PILES

- A. Unacceptable Piles: Piles that fail, are placed out of position, are below elevations, or are damaged.
- B. Provide additional piles or replace foundations failing to conform to specified requirements.

END OF SECTION

SECTION 32 13 13 - CONCRETE PAVING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Concrete sidewalks, stair steps, integral curbs, gutters, parking areas, and roads.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 07 92 00 - Joint Sealants: Sealing joints.

1.03 REFERENCE STANDARDS

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).
- B. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).
- C. ACI 302.1R - Guide for Concrete Floor and Slab Construction; 2004 (Errata 2007).
- D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.
- E. ACI 305R - Hot Weather Concreting; 2010.
- F. ACI 306R - Cold Weather Concreting; 2010.
- G. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
- H. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.
- I. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.
- J. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2015a.
- K. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.
- L. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.
- M. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2014.
- N. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.
- O. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.
- P. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2013.
- Q. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2013).
- R. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2004a (Reapproved 2013).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit reports for each concrete material and mix design test.

1.05 QUALITY ASSURANCE

- A. Follow recommendations of ACI 305R when concreting during hot weather.

- B. Follow recommendations of ACI 306R when concreting during cold weather.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Steel form material, profiled to suit conditions.
- B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D1751) or sponge rubber or cork (ASTM D1752).
 - 1. Thickness: 1/2 inch (12 mm).
- C. Form Release Agent: Colorless mineral oil that will not stain concrete, absorb moisture, impair natural bonding of concrete finish coatings, or affect color characteristics of concrete finish coatings.

2.02 REINFORCEMENT

- A. Steel Welded Wire Reinforcement: Plain type, ASTM A1064/A1064M; in flat sheets; unfinished.
- B. Dowels: ASTM A615/A615M, Grade 40 - 40,000 psi (280 MPa) yield strength; deformed billet steel bars; unfinished finish.
- C. Dowels at Expansion Joints: ASTM A615/A615M Grade 40 (280); smooth steel bars; unfinished finish.

2.03 CONCRETE MATERIALS

- A. Obtain cementitious materials from same source throughout.
- B. Cement: ASTM C150/C150M, Normal - Type I Portland cement, gray color.
- C. Fine and Coarse Mix Aggregates: ASTM C33/C33M.
 - 1. Fine Aggregates: Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances.
 - 2. Coarse Aggregates: Clean, uncoated, processed from natural rock or stone containing no clay, loam or foreign matter. Unless otherwise noted or mass concrete, use aggregate meeting #57 or #67 grading requirements.
- D. Fly Ash: **Do not use fly ash in exposed, finished concrete.**
- E. Water: Clean, and not detrimental to concrete.
- F. Air-Entraining Admixtures: ASTM C260/C260M.
- G. Chemical Admixtures: ASTM C494/C494M, Type B - Retarding, Type C - Accelerating, Type D - Water Reducing and Retarding, Type E - Water Reducing and Accelerating, Type F - Water Reducing, High Range, and Type G - Water Reducing, High Range and Retarding.
 - 1. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

2.04 ACCESSORIES

- A. Curing Compound: ASTM C309, Type 1, Class B.
- B. Slab Isolation Joint Filler: 1/2 inch (13 mm) thick, height equal to slab thickness, with removable top section that will form 1/2 inch (13 mm) deep sealant pocket after removal.
 - 1. Material: Closed-cell, non-absorbent, compressible polyethylene or polymer foam in sheet form.
- C. Tactile Warning Surfaces: Reference drawings and details for type and locations.

- D. Evaporation Retarder: ACI 302.1R: "Evaporation Retardant/Monomolecular Film", temporary protection from rapid moisture loss.

2.05 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
 - 1. For trial mixtures method, employ independent testing agency acceptable to SJCF for preparing and reporting proposed mix designs.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.
- D. Concrete Properties:
 - 1. Compressive strength, when tested in accordance with ASTM C39/C39M at 28 days; 4000 psi (27.6 MPa).
 - 2. Water-Cement Ratio: Maximum 45 percent by weight.
 - 3. Total Air Content: 4-7 percent, determined in accordance with ASTM C173/C173M.
 - 4. Maximum Slump: 4 inches (100 mm).
 - 5. Maximum Aggregate Size: 3/4 inch (19 mm).
- E. Aggregates: Proportion aggregates to provide a minimum of 50% coarse aggregate ratio to total aggregate.

2.06 MIXING

- A. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

3.02 SUBBASE

- A. See Section 31 20 00 - EARTH MOVING for construction of base course for work of this Section.
- B. Verify that compacted subgrade is dry and ready to support paving and imposed loads.
- C. Rework subgrade as required by soil compaction control and earthwork sections if weather or other conditions deteriorate previously prepared subgrade.
- D. Maintain moisture and degree of compaction specified in soil control until concrete is installed.
- E. Verify gradients and elevations of base are correct.

3.03 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.

3.04 FORMING

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.
- D. Concrete pours and keyway to run parallel with length of drives.

- E. Form shall be full depth of concrete.
- F. Leave forms in place for at least 12 hours after placing and finishing concrete.
- G. Clean and oil forms each time they are used.

3.05 REINFORCEMENT

- A. Place reinforcement at midheight of slabs-on-grade.
- B. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh plus 2 inch (50.8 mm), and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- C. Interrupt reinforcement at expansion joints. Continue steel reinforcement across construction joints.
- D. Place dowels at curb and gutters if poured separately.
- E. Place smooth dowels at expansion joints as detailed on drawings.

3.06 COLD AND HOT WEATHER CONCRETING

- A. Follow recommendations of ACI 305R when concreting during hot weather.
- B. Follow recommendations of ACI 306R when concreting during cold weather.
- C. Do not place concrete when base surface temperature is less than 40 degrees F (4 degrees C), or surface is wet or frozen.

3.07 PLACING CONCRETE

- A. Place concrete as specified in Section 03 30 00.
- B. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.
- C. Paving shall not be done when it is raining.

3.08 JOINTS

- A. Align curb, gutter, and sidewalk joints.
- B. Construction Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1 1/2 inches (38 mm) into concrete.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting building elements, concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
 - 1. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) 1 inch below finished surface for the installation of joint sealant.
 - 2. Locate expansion joints at intervals of 50 feet (15.25 m) unless otherwise indicated.
- D. Contraction (Control) Joints: Construct contraction joints in slabs-on-grade to form panels of patterns as noted or shown. Use tool cuts 1/8 inch (3 mm) wide by one-fourth of slab depth or inserts 1/4 inch (6 mm) wide by one-fourth of slab depth or saw cutting to a depth not less than 10 percent of slab thickness with a 1 inch (25 mm) minimum depth.
 - 1. Tooled Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces. Tool edges in exposed slabs.
 - 2. Saw Cutting: Slabs may be sawed if cut immediately and within 2 hours following final troweling using a "Soff-cut" saw or early entry dry-cutting saw system. Install cuts as soon as concrete will support weight of saw and operator without disturbing final finish.

3. If joint pattern is not shown, provide joints at a maximum spacing in feet equal to two times the slab thickness in inches.

3.09 FINISHING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Evaporation Retarder: In hot, dry, and windy weather apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq ft x h (1 kg/sq m x h) before and during finishing operations. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.
- C. Area Paving: Light broom, texture perpendicular to pavement direction.
- D. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius (6 mm radius).
- E. Curbs and Gutters: Light broom, texture parallel to pavement direction.
- F. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.10 TOLERANCES

- A. Maximum Variation of Surface Flatness: 1/4 inch (6 mm) in 10 ft (3 m).
- B. Maximum Variation From True Position: 1/4 inch (6 mm).
- C. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).

3.11 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
 1. Provide free access to concrete operations at project site and cooperate with appointed firm.
 2. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
- B. Compressive Strength Tests: ASTM C39/C39M; for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd (76 cu m) or less of each class of concrete placed.
 1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
 2. Perform one slump test for each set of test cylinders taken.
 3. One specimen tested at 7 days, two specimens tested at 28 days.
- C. Air Content Test: ASTM C173/C173M, volumetric method for lightweight or normal weight concrete; ASTM C231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
- D. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
- E. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.12 PROTECTION

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

- B. Do not permit pedestrian traffic over pavement for 7 days minimum after finishing.

END OF SECTION

SECTION 32 17 23.13 - PAINTED PAVEMENT MARKINGS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Parking lot markings, including curb markings and graphics as indicated.
- B. "No Parking" curb painting.

1.02 RELATED REQUIREMENTS

- A. Section 32 13 13 - Concrete Paving.

1.03 REFERENCE STANDARDS

- A. FS TT-P-1952 - Paint, Traffic Black, and Airfield Marking, Waterborne; Rev. E, 2007.
- B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, www.paintinfo.com.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver paint in containers of at least 5 gallons (18 L) .
- B. Store products in manufacturer's unopened packaging until ready for installation.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.05 FIELD CONDITIONS

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS**2.01 MATERIALS**

- A. Line and Zone Marking Paint: MPI (APL) No. 97 Latex Traffic Marking Paint; color(s) as indicated.
 - 1. Parking Lots: Yellow.
 - 2. Concrete Curbs at Loading Zones: Yellow
 - 3. Concrete Curbs at Fire Lanes: Red.
 - 4. Handicapped Symbols: Blue.
- B. Paint For Obliterating Existing Markings: FS TT-P-1952; black for bituminous pavements, gray for portland cement pavements.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify SJCF of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

- C. Obliteration of existing markings using paint is acceptable in lieu of removal; apply the black paint in as many coats as necessary to completely obliterate the existing markings.
- D. Clean surfaces thoroughly prior to installation.
 - 1. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods.
 - 2. Completely remove rubber deposits, existing paint markings, and other coatings adhering to the pavement, by scraping, wire brushing, sandblasting, mechanical abrasion, or approved chemicals.
 - 3. Sandblasting: Use equipment of size and capacity necessary, providing not less than 150 cfm (0.08 cu m per second) of air at pressure not less than 90 psi (625 kPa) at each nozzle used.
- E. Where oil or grease are present, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application; after cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint.
- F. Establish survey control points to determine locations and dimensions of markings; provide templates to control paint application by type and color at necessary intervals.

3.03 INSTALLATION

- A. Begin pavement marking as soon as practicable after surface has been cleaned and dried.
- B. Do not apply paint if temperature of surface to be painted or the atmosphere is less than 50 degrees F (10 degrees C) or more than 95 degrees F (35 degrees C).
- C. Apply in accordance with manufacturer's instructions using an experienced technician that is thoroughly familiar with equipment, materials, and marking layouts.
- D. Apply markings in locations determined by measurement from survey control points; preserve control points until after markings have been accepted.
- E. Apply uniformly painted markings of color(s), lengths, and widths as indicated on drawings true, sharp edges and ends.
 - 1. Apply paint in one coat only.
 - 2. Wet Film Thickness: 0.015 inch (0.4 mm), minimum.
 - 3. Length Tolerance: Plus or minus 3 inches (75 mm).
 - 4. Width Tolerance: Plus or minus 1/8 inch (3 mm).
- F. Parking Lots: Apply parking space lines, entrance and exit arrows, painted curbs, and other markings indicated on drawings.
 - 1. Mark the International Handicapped Symbol at indicated parking spaces.
 - 2. Hand application by pneumatic spray is acceptable.
- G. Symbols: Use a suitable template that will provide a pavement marking with true, sharp edges and ends, of the design and size indicated.

3.04 DRYING, PROTECTION, AND REPLACEMENT

- A. Protect newly painted markings so that paint is not picked up by tires, smeared, or tracked.
- B. Provide barricades, warning signs, and flags as necessary to prevent traffic crossing newly painted markings.
- C. Allow paint to dry at least the minimum time specified by the applicable paint standard and not less than that recommended by the manufacturer.

- D. Remove and replace markings that are applied at less than minimum material rates; deviate from true alignment; exceed length and width tolerances; or show light spots, smears, or other deficiencies or irregularities.
- E. Remove markings in manner to avoid damage to the surface to which the marking was applied, using carefully controlled sand blasting, approved grinding equipment, or other approved method.
- F. Replace removed markings at no additional cost to Owner.

END OF SECTION

SECTION 32 84 23 - UNDERGROUND SPRINKLERS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Rework and extension of pipe and fittings, valves, sprinkler heads, emitters, and accessories.
- B. Control system.

1.02 SCOPE OF WORK

- A. Design, Furnish, and Install the complete underground irrigation system for impacted areas of existing system, including all labor, materials, equipment, apparatus, and services for the testing, adjusting, re-testing and readjusting as required to place the system in an approved fully operating condition.
 - 1. Excavating and backfill and compaction for all work as specified, and is to include all machinery and labor.
 - 2. To complete underground irrigation system from the point of connection, throughout the site, including piping, fittings, valves, drains, sprinkler fittings; sprinkler heads, automatic controller(s) and any other necessary appurtenances.
 - 3. To furnish and install all piping, fittings, valves, valve boxes, valve covers, electric valve, wiring and appurtenances
 - 4. To test the impacted zones piping and wiring systems.
 - 5. To furnish and install sprinkler heads.
 - 6. To regulate and adjust all sprinkler heads within the impacted areas.
 - 7. To furnish a qualified, sprinkler system technician to instruct the Owner's operating personnel in the maintenance and operation of the irrigation system.

1.03 RELATED REQUIREMENTS

- A. Section 31 20 00 Earth Moving: Excavation and backfilling for irrigation piping.

1.04 REFERENCE STANDARDS

- A. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- B. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2015a.
- C. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.
- D. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings; 2004 (Reapproved 2011).
- E. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2015.
- F. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012.
- G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work with site backfilling, landscape grading and delivery of plant life.
- B. Preinstallation Meeting: Convene one week prior to commencing work of this Section.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

- B. Shop Drawings: Indicate piping layout to water source, location of sleeves under pavement, location and coverage of sprinkler heads, components, plant and landscaping features, site structures, schedule of fittings to be used.
 - 1. Plan layout shall include details illustrating location and type of heads, valves, piping circuits, controls and accessories. Submit technical data supporting layout design, including individual circuit (section) GPM and pressure loss calculations.
 - 2. Zoning Chart: Show each irrigation zone and its control valve.
- C. Product Data: Provide component and control system and wiring diagrams.
- D. Record Documents: Record actual locations of all concealed components piping system and conduit.
 - 1. This drawing shall indicate thereon all pipe sizes, valve locations, dimensional data from building walls or column center lines, to the piping and valves, sprinkler heads, etc. Accompanying the record drawings shall be instruction sheets and parts lists, covering all operating equipment, bound into a folder.
- E. Operation and Maintenance Data:
 - 1. Provide instructions for operation and maintenance of system and controls where existing system is extended to new areas, seasonal activation and shutdown, and manufacturer's parts catalog.
 - 2. Provide schedule indicating length of time each valve is required to be open to provide a determined amount of water.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience.

1.08 REGULATORY REQUIREMENTS

- A. Conform to applicable code for piping and component requirements.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of products in system.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Deliver irrigation system components in manufacturer's original undamaged and unopened containers with labels intact and legible.
- B. Deliver plastic piping in bundles, packed to provide adequate protection of pipe ends, both threaded or plain.
- C. Store and handle materials to prevent damage and deterioration.
- D. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.
- E. Provide secure, locked storage for valves, sprinkler heads, and similar components that cannot be immediately replaced to prevent installation delays.

PART 2 PRODUCTS

2.01 IRRIGATION SYSTEM

- A. Modifications and extension of system to match existing system, control solenoids and drain fashion.
- B. Manufacturers:
 - 1. Match existing.

2.02 PIPE MATERIALS

- A. PVC Pipe: ASTM D2241; 200 psi (1.38 MPa) pressure rated upstream from controls, 200 psi (1.38 MPa) downstream; solvent welded sockets.
 - 1. SDR 21 and SDR 26 pipe.
 - 2. PVC Socket Fittings: ASTM D2467, Schedule 80.
 - 3. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket or threaded ends.
- B. PVC Pipe: ASTM D1785, Schedule 40 and 80.
 - 1. PVC Socket Fittings: ASTM D2466, Schedule 40 and 80.
 - 2. PVC Threaded Fittings: ASTM D2464, Schedule 80.
 - 3. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket or threaded ends.
- C. Copper Pipe: ASTM B42, Type K, regular type.
 - 1. Used on all exposed pipes, including backflow preventer.
- D. Polyethylene Pipe: ASTM 2239 flexible polyethylene pipe rated at 100-psi minimum working pressure.
- E. Fittings: Type and style of connection to match pipe.
- F. Pipe Risers at Valves: 160 psi (1.10 MPa) PVC pipe.
- G. Solvent Cement: ASTM D 2564 for PVC pipe and fittings.
- H. Solder and Flux: ASTM B32 solder, with suitable flux.
- I. Sleeve Material: PVC.

2.03 OUTLETS

- A. Gear-Drive Rotary Type Sprinkler: Plastic, Pop-up type without screens; fully adjustable for pattern and flow; size as indicated; with letter or symbol designating degree of arc and arrow indicating center of spray pattern.
 - 1. Body Material: ABS.
 - 2. Nozzle: ABS or Brass.
 - 3. Internal Parts: Corrosion resistant.
- B. Spray Type Sprinkler Head: Plastic, Pop-Up head with full circle pattern; fully adjustable for pattern and flow.
 - 1. Body Material: ABS.
 - 2. Body Material: ABS.
 - 3. Internal Parts: Corrosion resistant.
- C. Emitter: Adjustable outlet, non-clogging, with two trickle tubes.
- D. Quick Couplers: Factory-fabricated, bronze or brass, two-piece assembly.
 - 1. Include coupler water seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.

2.04 VALVES

- A. Gate Valves and Drain Valves: Manufacturers standard of type and size required.
- B. Remote Control Valves:
 - 1. Manufacturers standard of type and size required.
 - 2. Diaphragm type with manual-flow adjustment and operated by 24-V ac solenoid.
 - 3. All valves will be located in valve boxes 10-inch minimum, plastic construction. Valve box shall be vandal resistant. Lift off lids are not acceptable.
- C. Backflow Preventers: Iron body construction, double check valve type.

1. Conforming to requirements of local authority having jurisdiction for turf irrigation systems.

2.05 CONTROLS

- A. Controller: Automatic controller, microprocessor solid state control with visible readout display, temporary override feature to bypass cycle for inclement weather, timer for a 6 station system, programmable for 14 days in 1 minute increments, with automatic start and shutdown.
 1. Controller Transformer: 24-V secondary, with primary fuse.
- B. Controller Housing: NEMA 250 Type 3; weatherproof, watertight, with lockable access door.

2.06 WIRING

- A. Electric control wires from each controller to the automatic valves shall be direct burial UF wire of a different color than the black and white wires used on the 115 volt A.C. power. Ground wire shall be required for each controller.
- B. All wire shall be spliced only at valve locations. Minimum size shall be a 14 gauge, solid single conductor, copper.
- C. Provide 10" expansion coil at each valve and at 100 intervals.

PART 3 EXECUTION

3.01 3.01 SYSTEM DESIGN

- A. Inspection: Examine existing elevations and conditions at site. Do not begin system design until all existing conditions are satisfactorily understood.
- B. Design Pressure: As indicated on drawing at connection to water supply. Actual working pressure in an individual circuit shall fall between manufacturer's recommended minimum and maximum operating pressures for the last sprinkler head in the circuit.
- C. Design Velocities: Velocity of water in sprinkler system should not exceed 5-6 fps.
- D. Location of Sprinkler Heads: Around perimeter of football field, if pressure allows, and in the D zones. Design for 100% radius overlap coverage. Locate sprinkler heads based on triangular spacing wherever possible. Do not spray sidewalks.
- E. Sectioning of Irrigation System: Individual circuits shall be designed so that total GPM required per circuit does not exceed available GPM. System shall be designed so that areas irrigated by individual circuits exhibit compatible conditions, including soil type, plant material type and sun exposure. System shall be designed so that sprinkler head types and precipitation rates of sprinklers are compatible on same circuit. Design system so that circuits furthest from supply require lowest total GPM. Design system so that each section includes one quick coupling valve.
- F. Piping: Avoid following piping layout situations:
 1. Avoid piping layout along sides of structures.
 2. Avoid odd angles in piping layout.
 3. Avoid unbalanced friction losses.
 4. Avoid high friction losses.
 5. Avoid excessive trenching.

3.02 EXAMINATION

- A. Verify location of existing utilities.
- B. Verify that required utilities are available, in proper location, and ready for use.

3.03 PREPARATION

- A. Piping layout indicated is diagrammatic only. Route piping to avoid plants, ground cover, and structures.
- B. Layout and stake locations of system components.
- C. Review layout requirements with other affected work. Coordinate locations of sleeves under paving to accommodate system.

3.04 TRENCHING

- A. If the pulling method is used, the pipe "plow" shall be a vibratory type. Starting and finishing holes for pipe pulling shall not exceed a 1'-0" by 3'-0" opening.
- B. Excavate to depths required to provide 2" depth of earth fill or sand bedding for piping when rock or other unsuitable bearing material is encountered.
- C. Fill to match adjacent grade elevations with approved earth fill materials. Place and compact fill in layers not greater than 6" depth. Provide approved earth fill or sand to a point 4" above the top of pipe. Fill with 6" of final grade with approved excavated or borrow fill materials free of lumps or rocks larger than 2" in any dimension. Provide clean topsoil free of rocks and debris for top 6" of fill. Install irrigation lines with a minimum cover of 24" for main lines. 12" for laterals based on existing finished grades.
- D. Trench to accommodate grade changes and slope to drains.
- E. Maintain trenches free of debris, material, or obstructions that may damage pipe.
- F. Excavate trenches and install piping and fill during the same working day. Do not leave trenches or partially filled trenches open overnight.

3.05 INSTALLATION

- A. Install pipe, valves, controls, and outlets in accordance with manufacturer's instructions.
- B. Connect to utilities.
- C. Backflow Preventer: Install backflow prevention valve, pump, booster pump, fittings and accessories required to complete the system. Provide union on downstream side. Install minimum 12" above highest ground level sprinkler head.
- D. Set outlets and box covers at finish grade elevations.
- E. Provide for thermal movement of components in system.
- F. Circuit Valves: Install in accordance to manufacturer's instructions. Install in valve box, arranged for easy adjustment and removal. Install valve access boxes on a suitable base of gravel to provide a level foundation at proper grade and to provide drainage of the access box. Provide union on downstream side. Seal threaded connections on pressure side of control valves with Teflon tape or plastic joint type compound. Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.
- G. Plastic Pipe: Install plastic pipe in dry weather when temperature is above 40 degrees F. in accordance with manufacturer's installation instructions. Provide for thermal expansion and contraction. Lay pipe on solid subbase, uniformly sloped without humps or depressions. For circuit piping, slope to drain valve at least 1/2" in 10' of lawn.
- H. Saw Cut Plastic Pipe: Use a square-in-sawing vice to insure a square cut. Remove burs and shavings at cut ends prior to installation.
- I. Make plastic to plastic joints in solvent weld joints or slip seal joints. Use only solvent recommended by the pipe manufacturer. Install plastic pipe fittings in accordance with pipe manufacturer's instructions. Owner shall make arrangements with pipe manufacturer for all necessary field assistance. Make plastic to metal joints with plastic male adapters. Make solvent weld joints in accordance with manufacturer's

recommendations. Allow joint to set at least 24 hours at temperature above 40 degrees F before pressure is applied to the system.

- J. Maintain pipe interiors free of dirt and debris. Close open ends of pipe by acceptable methods when pipe installation is not in progress.
- K. Install thrust blocks on distribution lines at locations that make an abrupt change of direction.
- L. Use threaded nipples for risers to each outlet.
 - 1. All risers to heads shall be constructed of nipples or elbows to permit height adjustment of head. Install heads two inches back of any hard surface.
- M. Install control wiring in accordance manufacturer's instructions. Provide 10 inch (250 mm) expansion coil at each valve to which controls are connected, and at 100 ft (30 m) intervals. Bury wiring beside pipe.
- N. Mark valves with neoprene valve markers containing locking device. Set valve markers in pipe risers extending from top of valve to finish grade.
- O. After piping is installed, but before outlets are installed and backfilling commences, open valves and flush system with full head of water.
- P. Drain pits shall consist of two (2) cubic foot well, filled to capacity with crushed stone. Drain locations shall be determined on job site by the contractor. Provide manual drains at all low points in the branch piping and in the main at intervals not to exceed 300 feet of pipe. Install drain at the end of a 4" PVC pipe and valve cover. Furnish Owner with valve handle extension.
- Q. Sprinkler Heads: Flush circuit lines with full head of water and install heads after hydrostatic test is completed. Install fittings, heads, risers and accessories in accordance with manufacturer's instructions. Set sprinkler heads perpendicular to finished grades at manufacturer's recommended heights.
- R. Install quick coupling valves with an adjustable double swing joint riser assembled by the use of at least 3 standard 90-degree elbows. Fabricate double swing joint risers of Schedule 80 PVC nipples and Schedule 40 PVC elbows.
- S. Control Wiring: Install electric control cable in the piping trenches wherever possible. Place wire in trench adjacent to pipe. Install wire with slack to allow for thermal expansion and contraction. Expansion joints in wire may be provided at 100 foot intervals by making 5 or 6 turns of the wire around a piece of 1/2' pipe instead of slack. Where necessary to run wire in a separate trench, provide a minimum cover of 12".
- T. Provide sufficient slack at site connections at remote control valves in control boxes and at all wire splices to allow raising the valve bonnet or splice to the surface without disconnecting the wires when repair is required.
- U. Connect each remote control valve to one station of a controller except as otherwise indicated. Connect remote control valves to a common ground wire system independent of all other controllers. Make wire connections to remote control electric valves and splices of wire in the field, using wire connectors and sealing cement in accordance with manufacturer's recommendations.
- V. Provide tight joints to prevent leakage of water and corrosion build up on the joint.

3.06 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 40 00 - Quality Requirements.
- B. Prior to backfilling, test system for leakage at main piping to maintain 100 psi (690 kPa) pressure for one hour.

- C. Flushing, Testing and Adjustment: After sprinkler piping and risers are installed and before sprinkler heads are installed, open control valves and flush out the system with fill head of water. Pressure test all lines before joint areas are backfilled. Backfill a portion of the trench area to maintain pipe stability during test period. All mainline piping shall be tested at a hydraulic pressure of 100 psi. Upon visual inspection of each joint and the ground, any leak detected shall be repaired. The line shall be re-tested until the necessary repairs made to put the system in good working order. After testing, the system shall be flushed with a minimum of 150% of the operation flow passing through each pipe, beginning with the larger mains and continuing through the smaller mains in sequence.
- D. System is acceptable if no leakage or loss of pressure occurs and system self drains during test period.
- E. Perform system testing upon completion of each section. Make necessary repairs and retest repaired sections as required.
- F. Adjust sprinklers after installation for proper and adequate distribution of the water over the coverage pattern. Adjust for the proper arc of coverage.
- G. Tighten nozzles on spray type sprinklers after installation. Adjust sprinkler-adjusting screw on lateral line or circuit as required for proper radius. Interchange nozzle patterns to give best arc of coverage.
- H. Adjust all electric remote control valve pressure regulators and flow control stems for system balance and optimum performance.
- I. Test and demonstrate the controller by operating appropriate day, hour and station selection features as required to automatically start and shut down irrigation cycles to accommodate plant requirements and weather conditions.

3.07 BACKFILLING

- A. Provide 3 inch (75 mm) sand cover over piping.
- B. Backfill trench and compact to specified subgrade elevation. Protect piping from displacement.

3.08 SYSTEM STARTUP

- A. Prepare and start system in accordance with manufacturer's instructions.
- B. Adjust control system to achieve time cycles required.
- C. Adjust head types for full water coverage as directed.

3.09 CLOSEOUT ACTIVITIES

- A. Instruct Owner's personnel in operation and maintenance of system, including adjusting of sprinkler heads. Use operation and maintenance data as basis for demonstration.

3.10 MAINTENANCE

- A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- B. Provide one complete spring start-up and a fall shutdown by installer, at no extra cost to Owner.

END OF SECTION